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HARKOM (J. F.). **Preservative treatment of poles by end-boring.**—6 pp., 2 figs., Ottawa, For. Prod. Lab., Canada, 1939. [Mimeographed.]

This is a full account of a cheap preservative treatment of poles, consisting in the insertion of chemicals in boles bored in the butt, reference to which has already been made [*R.A.M.*, xix, p. 507].

MCWHORTER (F. P.) & OWENS (C. E.). **Vein banding virus disease of Parsnips.**—*Plant Dis. Reptr*, xxiv, 9, p. 176, 1940. [Mimeographed.]

The young foliage of a few parsnips in a commercial planting in Oregon showed a chlorotic condition developing along the veins and expanding into disfiguring blotches. The appearance of the leaves thus affected is quite different from those attacked by western aster yellows, as reported by Severin [from California] (*Hilgardia*, vii, p. 177, 1932), and may be due to a hitherto undescribed virus.

JAGGER (I. C.) & WHITAKER (T. W.). **The inheritance of immunity from mildew (Bremia lactucae) in Lettuce.**—*Phytopathology*, xxx, 5, pp. 427–433, 1940.

The occurrence of five distinct physiologic races of *Bremia lactucae*, the agent of downy mildew of lettuce, is stated to be definitely established by observations and experiments in California [*R.A.M.*, xii, p. 417], while other evidence points to the existence of six or seven [ibid., xviii, p. 8]. In this paper the inheritance of immunity from race 5 among the progeny (down to F_3) of crosses between the susceptible Imperial F, D, 615, and 847 and the immune Grosse blonde d'hiver bourgignonne (Vilmorin-Andrieux) and a Russian strain of *Lactuca scariola* is described in detail, and was found to be dependent in a single dominant gene. Such genes have been detected only among the more primitive types of lettuce of European origin [loc. cit.], and no evidence of linkage could be traced between them and those responsible for the various morphological characters of the cultivated varieties.

The development of physiologic races of *B. lactucae* through mutation is inferred from circumstantial evidence, based in the first place on the mode of their appearance, and secondly on the fact that resistance to at least two is controlled by single gene differences.

KLUSHNIKOVA (Mme E. S.). Четырехспоровая дикая **Psalliota campestris,** ее особенности и отличия от культурной двухспоровой формы шампиньона. [The characteristics of the four-spored wild *Psalliota campestris* and its differentiation from the two-spored cultivated mushroom.]—*Bull. Soc. Nat. Moscou*, Sect. Biol., N.S., xlviii, 5–6, pp. 53–58, 11 figs., 1939.

In a comparative study of wild and cultivated mushrooms, fruit bodies of the wild, four-spored form of *Psalliota campestris* [*R.A.M.*, xvi, p. 365], collected near Moscow, were found to be morphologically very similar to those of the cultivated white form. The spores of the wild form, however, germinated after 15 days as compared with 8 to 9 for those of the cultivated form, and lost their viability after 7 to 8 months, while those of the cultivated form were capable of germination after two or three years. Whereas the cultivated form is normally grown on horse manure, the mycelium of the wild form did not develop on sterilized fresh horse manure, but throve on horse manure mixed with 50 per cent. garden soil. In view of these cultural differences the two forms are considered distinct. The results of cultural and cytological studies indicate that the wild form is homothallic.

MAHONEY (C. H.) & STIER (H. L.). **Influence of new sprays and dusts in the control of Cantaloupe defoliation and improvement of fruit quality.**—*Trans. Peninsula hort. Soc.*, xxix (*1939*), 5, pp. 162–165, [? 1940].

During 1939, a test was carried out in Maryland in which replicated plots in 12 acres of Pearl Pink Meat cantaloupe melons received 8 applications of either Bordeaux mixture [concentration unspecified], cuprocide (red copper oxide) 54, cuprocide 54–Y, Grasselli compound A, basicop, or duo-copper sprays, or copper sulphate cuprocide G–A, yellow copper oxide, or cupro-K dusts. As far as possible the same amount of metallic copper was applied per acre in all treatments, except in the case of the plots sprayed with Bordeaux mixture, which received approximately 25 per cent. more than the others.

The first disease to appear (20th July) was powdery mildew [*Erysiphe cichoracearum*: *R.A.M.*, xviii, p. 151]; this was followed by downy mildew [*Pseudoperonospora cubensis*: ibid., xiii, p. 286] on about 25th July, and by *Macrosporium* [*Alternaria* ? *cucumerina*: ibid., xvii, p. 364] in the first week in August. The best control of both mildews was given by Bordeaux mixture, yellow copper oxide spray, and red copper oxide dust. All the treatments were less effective in controlling *A.* ? *cucumerina* than in controlling the mildews; the most effective control was given by red copper oxide spray. The rates of application were as follows: early (late June), when the vines were beginning to run, 70 gals. spray and 16 lb. dust per acre; mid-season (to mid-August), 90 to 115 gals. and 30 lb., respectively; late 230 gals. The double-rate late spray gave a marked increase in the control of *A.* ? *cucumerina*, and clearly demonstrated the importance of good coverage, which, apparently, may be more important, in the case of this disease, than the form of fungicide used. Sprayers in commercial fields must have at least 300 lb. pressure at the nozzle, and the lower surface of the leaves should be covered.

BOTTOMLEY (A[VERIL] M.). **Sclerotium or footrot disease of Groundnuts.** —*Fmg S. Afr.*, xv, 170, pp. 189–191, 194, 3 figs., 1940.

In the northern Transvaal the most destructive and widespread disease affecting groundnuts is foot rot, due to *Sclerotium rolfsii* [*R.A.M.* xvii, p. 442; xix, p. 196]. The first serious outbreak occurred locally in 1936–7; infection was not much in evidence in 1937–8, but during the past two seasons the attacks have reached such alarming proportions in some districts that the future of the industry will be jeopardized if prompt measures are not taken to control the disease. Infected plants show one or more wilted or dead shoots or may appear to be conspicuously healthy and robust. In the case of the former the base of the stem just below soil-level is rotted through, while in that of the latter it is usually decayed except for a bundle of fibrous threads in the centre. Nutriment passes from the roots to the leaves through these threads, and until they become infected the plant does not appear to be diseased. This healthy appearance is attributed to the accumulation in the leaves of food which in normal conditions would pass to the nuts.

As the sclerotia require a great deal of moisture for their development, the disease is slight in dry, and severe in wet, seasons, especially if the rain falls in continuous spells. Infection is reduced in cold weather, and as the fungus cannot live without air it occurs only in the top 5 in. of the soil. The condition appears to be equally bad in all soil types found in the area concerned.

The only effective control consists in the use of resistant varieties. These, however, are all decumbent types unsuited to the local conditions. The best method of prevention is crop rotation. A cereal should follow immediately after diseased groundnuts, and should be planted, preferably, for two years. In the third year another legume, such as soybean, should be grown, after which the soil will have been cleared of infection to a considerable extent. Seed should be taken from a healthy crop, and should be fully mature, and of good size. Seed disinfection with mercurial dusts is recommended, since this destroys superficial infection and protects the seedling from attack by moulds. Deep ploughing also assists in control. The use of kraal manure on infected land is not advised. Virgin soil should be planted to a non-susceptible crop for a year or two before groundnuts are planted. Clean sanitation is of great importance, and cattle fed on diseased plants may spread infection.

WILLIAMS (T. L.). **Progress made in the production of varieties of Cassava resistant to mosaic disease.**—*Pap. Third W. Afr. agric. Conf., 1938* (Gold Coast Sect.), i, pp. 45–60, [? 1940].

A comprehensive, fully tabulated account is given of experiments in progress since 1933 at Kumasi, Gold Coast, in the development of mosaic-resistant cassava varieties [*R.A.M.*, xviii, p. 727]. Pedigree seedlings were produced by crossing one of the more resistant local varieties, e.g., Calabar Long Period No. S 115, with a susceptible imported or local variety, using the former as the male parent, and also by hybridization between pairs of resistant and susceptible varieties and between 'tree' cassava and the ordinary type. In 1936–7 six out of 32

of the 1933–4 pedigree strains remained free from infection in field experiments in which rows of heavily infected cuttings were interplanted with the selected seedlings, and two of these, C. 50 and C. 282A, with 8·2 and 12·2 per cent. mosaic compared with about 100 per cent. in the controls, were retained for further trial as combining tolerance of the disease with a reasonably palatable flavour and a low hydrocyanic acid content. Ten out of the twelve 1934–5 pedigree strains remaining immune were also retained for further experiments, and the preliminary results of the 1937–8 trials were favourable in respect of six. Up to the time of writing 31 out of the 62 healthy 1936–7 seedlings were free from mosaic at all the testing stations.

Cassava mosaic is much more severe near the coast than in the forest country, and the incidence of the disease reaches a climax towards the end of the rains and during the commencement of the dry season. The amount of infection on the above-mentioned selections, C. 50 and C. 282A, varied considerably at the different stations, the maximum for the former (11·5 per cent.) being reached at Aburi and the highest figure for the latter (23·4 per cent.) at Asuansi. The low incidence (0·0 per cent.) for both strains at Kumasi suggests a correspondingly small population of the insect vector of mosaic, *Bemisia nigeriensis*, in that district.

BRIANT (A. K.) & JOHNS (R.). **Cassava investigations in Zanzibar.**—*E. Afr. agric. J.*, v, 6, pp. 404–412, 1940.

In Zanzibar the incidence of cassava mosaic [see preceding abstract] is very high in all districts, an average of at least 60 to 75 per cent. of the plants being affected. In a variety trial in 1937 the local cassava variety Msitu gave a significantly better yield than six other varieties tested; there was a wide, but not a significant, difference between the yield of this variety and that of the next best, F. 100. In a further trial in 1938–9, Msitu, Mpezaze, and Kru (the last-named from the Gold Coast) gave significantly heavier yields than the five other varieties tested: F. 100, F. 64, E. 20, Sareso, and Pamba Mangubu, arranged in descending order of yield. A further test in which these and other varieties were grown in close proximity to infected cassava gave similar results. The [tabulated] data from varietal trials showed that the average yield of healthy plants is much higher than that of plants of the same variety with primary infection (i.e., symptoms exhibited on first leaves). Hence, yields may be considerably increased by planting only healthy cuttings and by replacing young diseased plants by healthy cuttings as soon as infection appears. The difference between the yields of healthy plants and those with secondary infection (i.e., acquired after planting) was not very marked. With few exceptions, the higher the total yield of a particular variety the fewer the plants in it with primary infection. Primary infection reduced the average yield of single plants of all varieties to a very low level, e.g., from 9·1 to 0·5 lb. for Kru, and from 11·3 to 4·9 for Ankrah, the first figure in each case being the average yield per healthy plant.

The small number of new infections recorded in the dry periods July–August (6), August–September (3), and December–January (8) would appear to have been due to the climatic conditions prevailing during

the preceding rainy periods (April–May, 13·04 in., May–June, 10·44, October–November 13·13, and November–December, 15·11).

SHEPHERD (E. F. S.). **Cocoyam root rot in the Gold Coast.**—*Pap. Third W. Afr. agric. Conf., 1938* (Gold Coast Sect.), i, pp. 83–86, [? 1940].

Summing up the results of protracted investigations, by H. A. Dade and J. Wright (presented by the former in hitherto unpublished notes covering the period from 1925–1933), on the root rot of coco-yams (*Xanthosoma sagittifolium* and *Colocasia antiquorum*) in the Gold Coast [*R.A.M.*, xix, p. 262], the writer reviews the present situation with regard to the disease, incorporating his own observations during a few months (at the time of writing) in the Colony. Plants growing in garden compost or uncleared bush do not suffer from the disease, which is prevalent in cleared land and persists in subsequent cultivation for at least three years. Rotted yams transferred to garden compost recover, while it was found impossible to induce artificial infection in plants growing in this medium by any of the usual methods. The rot is not correlated with any of the ordinary soil deficiencies or with the soil reaction.

It is apparent from these data that some specific agent or agents must be responsible for the trouble, and the facts that it is gradually spreading and that healthy stock immediately succumbs on transference to affected areas is strongly suggestive of parasitic infection. Attempts to secure evidence of the primary involvement of *Rhizoctonia* [*Corticium*] *solani* and *Pythium* sp. aff. *gracile*, the two fungi associated with the disease, have so far given inconclusive results, and these organisms would seem to be subsidiary to some soil-inhabiting pathogen (or a toxin in Wright's opinion), possibly a bacterium or a new type of virus, capable of attacking coco-yam roots in soils containing the decaying roots of undergrowth left in the ground according to the common local practice. *C. solani*, though frequently isolated in pure culture from diseased root tissue, has also been found in association with the roots of healthy plants in areas where the rot has never been recorded.

PETRI (L.). **Rassegna dei casi fitopatologici osservati nel 1939.** [Review of phytopathological records noted in 1939.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 1, pp. 1–70, 12 figs., 1940.

This report [cf. *R.A.M.*, xix, p. 68] contains numerous items of phytopathological interest, of which the following may be mentioned. Spraying tests against vine mildew (*Plasmopara viticola*) in different parts of Italy with Casale's mixtures showed that both the acid form (200 gm. copper sulphate, 50 gm. citric acid, and 50 gm. sodium carbonate per 100 l. water) and the neutral (200 gm. copper sulphate, 200 gm. sodium sulphate, 50 gm. citric acid, and 200 gm. calcium carbonate per 100 l. water, with the addition at the end of summer of 200 gm. of ferrous sulphate to increase adhesiveness) gave encouraging results. The two mixtures are almost as effective as Bordeaux mixture during the period when spray applications are very frequent, and provided the season is not very wet. In 1939 the acid mixture again caused leaf scorch. Attempts to control olive knot (*Bacterium* [*Pseudomonas*] *savastanoi*) [ibid., xviii, p. 330] in the Razzo variety growing on a

hillside by cutting away the infected parts and disinfecting the wounds with zinc chloride failed to prevent the disease from spreading, though the same variety growing lower down in the valley remained almost entirely unaffected. Olives in several localities were severely affected by *Cycloconium oleaginum* [ibid., xvii, p. 405]. Groves treated in October, 1938, and May, 1939, with Bordeaux mixture or either of two mixtures containing calcium cyanamide remained perfectly healthy. At Rieti many young olives succumbed to infection by *Dematophora* [*Rosellinia*] *necatrix* [ibid., xvi, p. 688], compacted soil being a predisposing factor.

Pear branches and shoots were attacked by canker (*Nectria galligena*), and apple fruits from Bologna by *Schizophyllum commune*. *Cercospora circumscissa* [ibid., xvii, p. 507] and *Phyllosticta persicae* occurred on peach leaves from Littoria, and loquats were extensively attacked by *Fusicladium dendriticum* var. *eriobotryae* [ibid., xvii, p. 556]. Leaves of *Zizyphus vulgaris* [*Z. jujuba*] showed reddish spots due to *Septoria capensis*. *Ascochyta heteromorpha* [ibid., xiii, p. 308] caused infection of oleanders in two localities; in several other districts the same host was attacked by *Bact. tonellianum* [ibid., xiii, p. 748]. Mulberry leaves from Italian East Africa showed the presence of *Bact. mori* and a species of *Phyllosticta* which formed ashy-white colonies with pycnidia containing oval or ellipsoidal conidia, reddish-cream in the mass, 4·5 to 5 by 2·4 to 4 μ, with darker plasma at each extremity; the mycelium showed numerous uni- or bicellular chlamydospores, which were darker than the light chestnut-coloured hyphae.

Owing to the exceptionally wet spring wheat in several localities became attacked by *Gibberella saubinetii*. Foot rot of the same host was associated with *Leptosphaeria herpotrichoides* and *Fusarium* sp. *Septoria nodorum* was common on wheat, *S. tritici* and *S. graminum* being of less importance. The variety Girolamo Caruso at Fiume was infected by *S. glumarum*.

Lupinus luteus showed root rot due to *Sclerotinia sclerotiorum*. Near Rome the same host showed severe infection of the leaves, stems, and leaf stalks by *Macrosporium* [*Stemphylium*] *sarciniforme* [ibid., xviii, p. 116]. Tomatoes were infected by *Bact. vesicatorium* and *Pseudomonas* [*Bact.*] *solanacearum*.

Gladiolus at Viareggio showed dry rot due to *Fusarium oxysporum* var. *gladioli* [ibid., xvi, p. 335].

Alexopoulos (C. J.). **Some fungi from Greece.**—*Mycologia*, xxxii, 3, pp. 336–358, 43 figs., 1940.

This annotated, illustrated list of parasitic fungi collected by the author in Greece between October, 1938, and April, 1939, or identified by him, includes *Actinomyces scabies* on potatoes (causing great damage throughout the country); *Lophodermium pinastri* on leaves of *Pinus halepensis* (the first record of this fungus from Greece); *Gymnosporangium sabinae* on pear trees (very common, causing considerable damage in all localities); *Uromyces appendiculatus* on leaves of *Phaseolus vulgaris* (found wherever beans are grown); *Septoria piricola*, the conidial stage of *Mycosphaerella sentina* (causing much damage to pear leaves in all localities); *S. tritici* on wheat from Larissa (reported to have caused 15 to 25 per cent. infection in the field where the specimen was collected);

Ascochyta pisi on broad bean leaves; *Oidium leucoconium* [*Sphaerotheca pannosa*] on peaches and roses (common, and causing considerable damage); *Botrytis cinerea* on mature grapes (very damaging); and *Macrosporium vitis*, a fungus new to Greece, also on mature grapes.

PADWICK (G. W.). **Report of the Imperial Mycologist.**—*Sci. Rep. agric. Res. Inst., New Delhi, 1938–9*, pp. 103–115, 1940.

The following are among the items of interest in this report [cf. *R.A.M.*, xviii, p. 499]. Progress is reported in breeding wheat varieties resistant to loose smut [*Ustilago tritici*: ibid., xviii, p. 585], others resistant to flag smut [*Urocystis tritici*], and oats resistant to [covered] smut [*Ustilago kolleri*], a number of resistant varieties being obtained in each case.

Some 50 per cent. of the maize seedlings growing in soil inoculated with a *Pythium* associated with a severe attack of root rot in Bihar were killed, the pathogen being reisolated from the roots.

Natural transmission of sugar-cane mosaic through the agency of aphids has been shown to occur to a slight extent in various parts of northern India, and in one locality in the Punjab *Aphis maidis* has been found colonizing on sorghum and an indigenous thin reed cane. A barley crop was found to be infested by *Toxoptera graminum*, another vector of the disease [ibid., xvii, p. 555]. In the same district a ratoon cane crop adjoining an aphid-infested sorghum stand developed 100 per cent. mosaic on the side next to the sorghum but none on the opposite side of the field. The rate of natural transmission is low and disease-free cane may be produced from setts cut from infected canes [ibid., xviii, p. 500] so that the rate of increase of mosaic in the crop grown year after year need not necessarily be very great. Highly successful results have been obtained by selecting setts from healthy canes in a very heavily infected crop; at Pusa, for instance, a stand raised from selections from a crop of Co. 313 with 70 to 90 per cent. infection developed only 3 per cent. mosaic.

Roguing has been found to give rapid and effective control of sugar-cane smut (*U. scitaminea*). The incidence of top rot (*Fusarium moniliforme*) [*Gibberella fujikuroi*] at Delhi on the Co. 313 variety ranged from 2·4 to 20·8 per cent. in three different plots. No evidence of loss of weight from the disease in the Co. 312, 313, 285, and 223 varieties was obtained, the same applying to Surkha Saharanpuri at Karnal. Up to 33 per cent. infection by *Bacillus* [*Bacterium*] *rubrilineans* was observed in some of the 85 varieties studied at the Sugar-Cane Research Station in the Punjab in a severe outbreak of red stripe.

Spores of linseed rust (*Melampsora lini*) were found to germinate better in distilled than in tap water, the optimum temperature for the process being 22° C., with a range from 10° to 25°. Spores from two separate collections of the rust from Pusa and Karnal were used for the inoculation of linseed type Pusa 21 and flax variety J.W.S.; the latter strain produced very heavy infection on Pusa 21 and none on J.W.S., whereas the former was only moderately pathogenic to Pusa 21 and slightly so to J.W.S. These results are considered to point to the existence of two physiologic races of *M. lini* in India.

Pending a decisive outcome of the experiments in progress to determine the identity of the *Fusarium* causing gram [*Cicer arietinum*]

wilt, no conclusion can be reached as to its taxonomic status, whether a new species or merely a physiologic race of *F. orthoceras* var. *pisi*. The disease was shown to be closely correlated with high temperatures, and to be equally severe in unsterilized and sterilized soils, indicating the absence of biological antagonism as a controlling factor. Late sowing (coinciding with a fall in temperature) was shown by a replicated field experiment to reduce the incidence of wilt (from 11·5 per cent. in the 30th September sowing to 0·1 and 0·0 per cent., respectively, in those of 21st and 28th October).

The results of cross-inoculation tests to determine the connexion between the *F.* spp. responsible for pigeon pea and sann hemp [*Crotalaria juncea*] wilts denoted a fairly high degree of specificity in the two fungi in relation to their appropriate hosts: the pigeon pea strain (12 isolates) infected up to 10 out of 24 seedlings of its own host and 6 out of 23 *C. juncea* (one isolate only), while the *C. juncea* strain attacked up to 11 out of 23 seedlings of its own host and one out of 24 pigeon peas (one isolate only). *F. vasinfectum* from *C. juncea* was pathogenic to 2 out of 24 pigeon peas and 7 out of 23 *C. juncea*.

None of the 50 tobacco plants to which white flies (*Bemisia gossypiperda*) fed on the juice of plants infected by leaf curl were transferred contracted the typical symptoms of the disease [ibid., xviii, p. 499; xix, p. 568]; though 11 showed vein-clearing with an approximation to leaf curl in 5.

F. sp. and *Colletotrichum* sp. were the principal organisms isolated from betel vines (*Piper betle*) [ibid., xviii, p. 234] affected by severe wilt or root rot in central India.

The histological examination of banana suckers from Cuttack, Orissa, whence widespread decay of the crop was reported, gave strong indications of the implication of the destructive bunchy top virus in the condition. [In the Annual Report of the Department of Agriculture, Assam, for 1937–38, p. 67, 1939, the Economic Botanist (S. Hedayetullah) records the presence of the same disease in dwarf bananas in the Bahara region.]

In the course of fortnightly inspections of the Delhi markets, scab [*Venturia inaequalis*] in the *Fusicladium* stage was found causing infection of up to 80 per cent. of the apple consignments from the Punjab and United Provinces. *Aspergillus japonicus* was shown to be responsible for losses amounting to 20 per cent. among pears [ibid., xviii, p. 188]. These surveys have shown that imported fruits are much less liable to spoilage than the corresponding Indian produce, in which the trouble usually originates from injuries inflicted before or during transport. Damage of this type, frequently involving very heavy losses, is more or less restricted to certain districts.

Plant diseases. Notes contributed by the Biological Branch—*Agric. Gaz. N.S.W.*, li, 6, pp. 327–330, 3 figs., 1940.

Banana-growers in New South Wales seeking to profit by an intercrop are warned that if the seed of such intercrop carries even a trace of the virus of infectious chlorosis or heart rot [a strain of cucumber virus 1: *R.A.M.*, xix, p. 482] and an aphid infestation occurs during autumn, many young banana plants will be destroyed. As cowpeas are suscep-

tible [ibid., xv, p. 196], it is considered to be highly probable that losses may occur where these are used as a cover crop, particularly if they are not disposed of in early autumn.

Potatoes in New South Wales are stated to be affected by brown fleck or internal brown spot [cf. ibid., xvii, p. 160], characterized by brown or yellow regions of dead tissue scattered throughout the tuber. The condition occurs chiefly on light, gravelly soil in dry seasons. Land conducive to its development should be avoided, and though there is no evidence of transmission by tubers, affected tubers should not be used as seed-stock.

WENHOLZ (H.), PRIDHAM (J. T.), VEARS (C. K.), & CURTEIS (W. M.). **Wheat varieties in Australia.**—*Agric. Gaz. N.S.W.*, xlix, 11, pp. 583–586; 12, pp. 649–652; l, 1, pp. 13–17; 2, pp. 71–74, 86; 3, pp. 131–135; 4, pp. 181–184; 5, pp. 236–238, 284; 6, pp. 308–311; 7, pp. 361–365; 8, pp. 417–420; 10, pp. 539–543; li, 1, pp. 11–14, 30; 2, pp. 65–68; 3, pp. 133–137; 4, pp. 195–198; 5, pp. 242–244; 6, pp. 312–314, 347; 7, pp. 371-373, 397, 42 figs., 1938–1940.

In this series of papers the authors give descriptive notes on all wheat varieties bred or produced in Australia, as well as on introduced varieties that have been of significance in cultivation or breeding work on the continent. Reaction to disease is specified in the case of many varieties.

WADDELL (W. H.). **A study of the relation between the seedling and mature-plant reaction to Puccinia graminis tritici in Durum Wheat-crosses involving Iumillo.**—*Canad. J. Res.*, Sect. C, xviii, 6, pp. 258–272, 1 fig., 1940.

All seedlings of three durum wheat crosses, Iumillo × Mindum A and B, and Pentad × Iumillo, found to be resistant to *Puccinia graminis tritici* race 21 in the greenhouse, were likewise resistant to all the races of the rust in the field in the mature stage; those found susceptible in the greenhouse were also susceptible in the field. A third group comprised lines that were susceptible in the seedling stage, but resistant as mature plants. It was observed, however, that as susceptibility increased in the seedling stage, there was an increase in the amount of rust in mature plants. The variety Iumillo appears to possess a factor or factors for mature plant resistance and another or others for resistance at both stages of maturity. The reaction to rust in the hybrid lines does not seem to be inherited in a simple Mendelian manner, being influenced in the Iumillo × Mindum crosses by the two types of resistance in Iumillo, and in the Pentad × Iumillo crosses also by additional factors for resistance in the Pentad parent. Seed colour was inherited in the Iumillo × Mindum crosses in a simple 3 : 1 ratio, red seed being dominant. There appeared to be no correlation between seed colour and rust reaction. It is concluded that for breeding purposes greenhouse tests with only one race of the rust can be employed for the elimination of susceptible lines of durum wheat crosses involving Iumillo.

RICE (W. N.). **The hemocytometer method for detecting fungous spore load carried by Wheat seeds.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1939*, pp. 124–127, 1940.

The following method was used for the estimation of the spore load

of various fungi carried by wheat seeds. One hundred seeds of a given lot are placed in a test tube together with 5 ml. of water, and the tube is corked and shaken fifty times, since separate experiments indicated that about 85 per cent. of spores were thus washed off. A drop of the suspension is then placed on the haemocytometer and the cover glass immediately set in place; the spores are counted in the measured volume of the haemocytometer from which the number of spores per kernel is readily calculated. It was found by the chi-square test that counting the number of spores in a quarter of the field of five different mounts gave a better estimate of spore load per kernel than by counting the spores in the whole field of a mount. An examination of wheat samples showed a range of from 59 to 22,344 *Tilletia* spores, 0 to 10,584 *Alternaria* or *Macrosporium* spores, and 0 to 59 *Helminthosporium* spores per kernel. Samples of seed in which no spores of *H. sativum* were detected by this method, nevertheless developed typical symptoms of disease and it is concluded that spore load alone is not an adequate criterion for the extent of probable injury to germination by this fungus.

GRACE (N. H.). **Effects of two preparations of naphthylacetic acid on the germination and early growth of Wheat seed damaged by formaldehyde.**—*Canad. J. Res.*, Sect. C, xviii, 6, pp. 215–218, 1940.

In further experiments on the response of formaldehyde-treated wheat seed-grain to naphthylacetic acid [*R.A.M.*, xix, p. 206], seeds of Marquis and Reward wheats were sprinkled either with formalin (37 per cent. by weight) alone or a solution containing formalin (1 in 320) and naphthylacetic acid (5 and 50 p.p.m.) at the rate of 10 c.c. to 50 gm. of seed, effecting treatments of 1 and 10 parts of the acid to 1,000,000 of wheat by weight. Two preparations of the acid were used, one of which had a trace of halogen. In both varieties of wheat formalin alone reduced the average germination rate (from a mean of the two varieties of 0·613, as computed by Bartlett's method (*J.R. Statist. Soc. Suppl.* iv, pp. 137–183, 1937), for the untreated control to 0·572), the final germination count (from 41·1 to 36·9 per cent.), and the air-dry weight of stems (from 0·736 to 0·601) and roots (from 0·264 to 0·172) at 29 days after planting, the corresponding figures for treatment with formalin and naphthylacetic acid (1 and 10 p.p.m.) being 0·608 and 0·564, 38·5 and 38·7, 0·645 and 0·628, and 0·194 and 0·188, respectively. Some reduction of formaldehyde injury therefore resulted from the 1 p.p.m. concentration of hormone, but the 10 p.p.m. concentration had no significant effect. The presence of a trace of halogen did not influence final germination or stem and root weights, but increased the germination rate. This effect was more marked at the highest concentration and Marquis was affected to a greater extent than Reward

VANTERPOOL (T. C.). **Studies on browning root rot of cereals. VI. Further contributions on the effects of various soil amendments on the incidence of the disease in Wheat.**—*Canad. J. Res.*, Sect. C, xviii, 6, pp. 240–257, 4 figs., 1940.

In further experiments on the browning root rot of wheat, associated with *Pythium* spp. (including *P. arrhenomanes* and *P. tardicrescens*) [*R.A.M.*, xv, p. 141; xviii, p. 165], phosphatic, nitrogenous, and potassic

fertilizers (at rates equivalent to 100 lb. phosphorus pentoxide, 96 lb. nitrogen, and 98 lb. potassium oxide per acre) were added at the time of planting to pots of soil naturally infested with *Pythium* spp. An improvement in growth resulted from the application of phosphorus; nitrogen applied singly had little effect, but when both were applied together, the increase in growth was greater than with phosphorus alone. Phosphorus appeared to be the chief deficient element. The phosphates, especially those containing nitrogen, increased the number and length of crown roots, the number of tillers, and the dry weight of plants, but had little, if any, effect in increasing the resistance of the plant tissue. The beneficial effect of phosphorus is believed to lie in the fact that by stimulating root development it helps the plants to escape infection. The phosphate-fixing power of infested and normal soils did not differ appreciably. Typical browning soils were not found to be seriously lacking in boron, copper, manganese, or zinc. Substantial increases in the growth of wheat seedlings in infested soil resulted from the application of either gypsum or triple superphosphate and from the two combined, as well as from heavy applications of sulphur, and addition of farm manure, ground cereal straw, sweet clover [*Melilotus*] hay, and weed hay. Browning soil was found deficient in phosphate for non-cereal crops such as lucerne, buckwheat, carrots, flax, lettuce, and sweet clover. These crops were not attacked by *P.* spp. parasitic on cereals and their poor growth is ascribed entirely to phosphate deficiency, while in wheat it is believed to be due to parasitic fungi as well. The results of this study are taken to indicate that browning root rot is due to lack of nutrient balance and depletion in soil fertility, factors predisposing the seedlings to attacks by the root-destroying fungi. It is suggested that artificial fertilizers and organic residues or manure should be applied to soils subject to this disease.

Putterill (Miss K. M.). **Two important foot-rots of Wheat and Barley.** —*Fmg S. Afr.*, xv, 171, pp. 219–220, 1940.

Foot rots of wheat and barley are stated to cause yearly increasing damage in the grain-growing areas of the northern Transvaal. The two most important are the common form of foot rot caused by *Helminthosporium sativum* [*R.A.M.*, xviii, p. 513] and a number of associated fungi, and the take-all disease caused by *Ophiobolus graminis* [ibid., xix, p. 335]. The control measures recommended against these two diseases include, for the former, the use of clean seed, seed disinfection with agrosan or ceresan, crop rotation over a minimum period of two years, wheat or barley being planted after a leguminous crop, and the application of complete fertilizers to the soil; and for the latter crop rotation over two years, preferably with legumes as an alternative crop, and early fallowing of the soil after an infected crop.

Young (V. H.) & McClelland (C. K.). **Seed treatments for Corn, Oats, and Barley in Arkansas.**—*Bull. Ark. agric. Exp. Sta.* 389, 27 pp., 1940.

Some of the data assembled in this bulletin on oats and maize seed-grain disinfection have already been published [*R.A.M.*, xiii, pp. 157, 503]. Fulghum oats from plots badly affected with loose smut (*Ustilago*

avenae) the preceding season were planted each year from 1933 to 1936. Beginning with 20 per cent. of diseased panicles in 1932, the incidence of loose smut had increased to nearly 50 per cent. by 1936. Untreated seed-grain from apparently healthy plots invariably gave rise to between 3 and nearly 12 per cent. smutted panicles, but almost perfect control of the disease resulted from the application of the formaldehyde spray (*Misc. Publ. U.S. Dep. Agric.* 21, 1928), dip, or dust (corona oat dust), or 2 per cent. ceresan (3 oz. per bush.). No evidence was obtained of the exertion of any stimulatory action by ceresan. The results of experiments on Missouri Beardless barley from 1936 to 1938, inclusive, may be summarized as follows. Both *Ustilago nuda* and *U. nigra* were concerned in the causation of loose smut, as indicated by the favourable response of the seedling phase of the disease to superficial treatment with new improved ceresan, which would obviously be ineffectual against internal (blossom) infection. The average incidence of loose smut in the three years in the lots treated with new improved ceresan (½ oz. per bush.), hot water (one minute at 120° F. and 13 at 126°, preceded by six hours' soaking at room temperature), and formaldehyde (1 pint in 40 gals., room temperature) was 4·48, 0·22, and 5·38 per cent., respectively, compared with 6·94 for the untreated controls, the corresponding figures for covered smut (*U. hordei*) being 0·02, 2·52, 1·55, and 6·16 per cent., respectively; no significant differences in the yields were found. Definite indications were available that new improved ceresan conferred protection against the soil as well as the seed-borne spores of both smuts, whereas the other two methods were effective against the latter only.

Rosen (H. R.) & Weetman (L. M.). **Longevity of urediospores of crown rust of Oats.**—*Bull. Ark. agric. Exp. Sta.* 391, pp. 20, 1940.

This is an expanded, tabulated account of the writers' studies on the longevity of the uredospores of physiologic race 1 of crown rust of oats (*Puccinia coronata avenae*) the outcome of which, denoting the unimportance of this factor in relation to the perpetuation of the disease under Arkansas conditions, has already been noticed from another source [*R.A.M.*, xviii, p. 306].

Stiemens (Brenda). **Survival of fungi in the digestive tract of cattle.**—*S. Afr. J. Sci.*, xxxvi, pp. 220–224, 1939.

In an experiment carried out in South Africa *Diplodia zeae* on oats (20 gm.) was fed to each of two oxen daily from 22nd to 26th February, 1939, a third ox receiving on the same dates 40 gm. oats infected with *Gibberella saubinetii*. Examination of the faeces, made daily from 23rd February until 1st March, showed that the spores of *D. zeae* recovered were no longer viable, and failed to germinate on fresh manure. In turnip extract plus manure fresh spores germinated but failed to develop further. No spores of *G. saubinetii* were recovered, fresh spores of the same fungus also making no growth on manure. The infection of plants by these fungi through manure is therefore considered only a very remote possibility.

Barre (H. J.). **Results of research in Corn storage.**—*Agric. Engng, St. Joseph, Mich.*, xxi, 6, pp. 219–222, 2 figs., 2 graphs, 1940.

In connexion with a study in Illinois and Iowa on the various phases

of maize storage, a survey of cribs in September, 1938, revealed a high incidence of [unspecified] mould in those with defective roofs. Observations were made to the effect that early-picked maize with a high moisture content is liable to contract mould damage within a few weeks of placing in the crib under warm-weather conditions, a fact that should be considered in weighing the relative advantages of early harvesting and the superior quality of a drier product.

HOPPE (P. E.). **Relative prevalence and geographic distribution of various ear rot fungi in the 1939 Corn crop.**—*Plant Dis. Reptr*, xxiv, 11, pp. 210–213, 1940. [Mimeographed.]

The 1939 platings on potato dextrose agar of samples of damaged maize kernels taken from car-loads at terminal markets in the United States [cf. *R.A.M.*, xviii, p. 669] showed that in Maryland and Delaware ear rots were about 2½ times as prevalent in the field as they were in the Corn Belt States. The most prevalent fungi isolated from the two seaboard States were (in descending order) *Diplodia zeae*, *Fusarium moniliforme* [*Gibberella fujikuroi*], and *G. saubinetii*, which together accounted for about 75 per cent. of the damage. The incidence of the last-named fungus was below its average for seven years. In Ohio, Indiana, and Illinois approximately 75 per cent. of the damaged kernels gave *D. zeae* and in Minnesota, Iowa, and Missouri 56·6 per cent., while only 17·4 of the Iowa samples gave *G. fujikuroi*. In Kansas, Nebraska, Colorado, and Texas *G. fujikuroi* was, as usual, the predominant fungus. The tendency for the ratio of *Aspergillus* spp. to *Penicillium* spp. to increase in the western and south-western areas of the United States was again observed.

Mould in sliced bread.—*Aust. Baker*, xliii, pp. 21–26, 1940. [Abs. in *Aust. chem. Abstr.*, ii, p. 21, 1940.]

Microban, a propionic acid salt, is claimed to be an effective deterrent of mould growth in bread at the rate of 3 oz. per 100 lb. flour [*R.A.M.*, xix, p. 528].

EDWARDS (E. T.). **The biological antagonism of Gibberella fujikuroi and Gibberella fujikuroi var. subglutinans to Trichoderma viride, with notes on the pathological effects of the latter fungus on Maize.**—*J. Aust. Inst. agric. Sci.*, vi, 2, pp. 91–100, 3 figs., 1940.

In the course of a study in Wisconsin on the seedling blight diseases of maize caused by *Gibberella fujikuroi* and its var. *subglutinans* [*R.A.M.*, xix, p. 469], it was observed in an appreciable number of cases that maize seedlings derived from either inoculated or internally infected kernels made better growth and were considerably more vigorous than the controls raised from uninoculated seed grains. It was further found in two series of experiments, in which the same observation was made on maize seedlings growing at 28° C., that the control seedlings, which were stunted and uneven in growth, yielded profuse quantities of *Trichoderma viride*, no trace of which could be detected in the seedlings grown from inoculated kernels. These observations are explained on the basis of an antagonistic relationship between the two types of *Gibberella* and *T. viride*, the latter being inhibited in the presence of either of the

former. A limited number of experiments to demonstrate such a relationship in culture, however, gave negative results. The attention is drawn to the pathological effects of *T. viride* on maize, although it is not yet known whether these effects are due to active parasitism on the part of the fungus or to toxic substances secreted by the fungus after it has become established as a saprophyte.

Van der Plank (J. E.), Rattray (J. M.), & van Wyk (G. F.). **The use of wraps containing o-phenylphenol for Citrus fruits.**—*J. Pomol.*, xviii, 2, pp. 135–144, 1940.

In experiments in South Africa with wraps impregnated with ortho-phenylphenol [*R.A.M.*, xix, p. 288], those containing 15 mg. of the preservative and 100 mg. of peanut [groundnut] oil per sq. ft. reduced the amount of *Penicillium digitatum* infection in two lots of commercially packed oranges stored for four weeks at 40° F. and then for 10 to 14 days at 65° from 5·34 and 6·63 per cent. in the controls (plain wraps) to 1·44 and 1·98 per cent. respectively; in Marsh grapefruit stored for four weeks at 60° from 2·12 to 0·89 per cent.; and in lemons stored for three weeks at 50° and one week at 65° from 11·44 to 1·09 per cent. With wraps containing only 5 mg. per sq. ft., the percentage of infected lemons was reduced from 4·31 to 1·90, and with wraps containing 9 mg. from 8·39 to 1·11 per cent. A gradual increase of the strength of the preservative from 0 to 24 mg. per sq. ft. was followed by a gradually increasing reduction in the amount of infected fruits. For practical purposes, however, the important point is that even with 9 mg., infection in lemons was reduced by about 87 per cent., the remaining decay being of no great commercial importance. It is considered doubtful, therefore, whether the potential extra reduction from a stronger preservative is worth striving for, since it would necessarily involve either greater risk of rind injury or the use of oil to obviate this risk.

The use of impregnated wraps containing 15 mg. ortho-phenylphenol and 100 mg. oil per sq. ft. reduced infection by *P. italicum* in oranges from 1·02 to 0·11 per cent. and wraps containing 8·7 mg. of the preservative per sq. ft. infection by *Trichoderma lignorum* [*T. viride*] in lemons from 5·8 to 0·2 per cent., preventing in the latter case the spread of the fungus by contact.

Oranges and grapefruit are rather more susceptible to injury by ortho-phenylphenol than lemons. With wraps containing 5 mg. per sq. ft. no injury was recorded in either of the three fruits but those containing 9 mg. caused an average of 8·9 per cent. injured fruits (of which 1·3 per cent. were severely injured) in oranges and 3·4 per cent. (mostly with quite inconspicuous injuries) in lemons; those containing 8 mg. caused 0·5 per cent. severely, and 3·5 per cent. mildly, injured fruits in grapefruit. The rind injury was effectively controlled by the use of glyceride oils. With 100 mg. groundnut oil up to about 15 mg. ortho-phenylphenol per sq. ft. can be fairly safely used for most lemons, but the amount tolerated by oranges is lower.

Bliss (D. E.). **The decline disease or Omphalia root rot of the Date Palm.**—*Rep. Date Grs' Inst., 1939*, pp. 7–8, [? 1939].

In experiments conducted in the Coachella Valley, California, under

orchard conditions, pure cultures of *Omphalia pigmentata* and *O. tralucida* [*R.A.M.*, xvii, p. 744] were inoculated into healthy five-year-old date palms and produced root-rot symptoms characteristic of the decline disease in eighteen varieties, including the Deglet Noor. The lesions were similar to those found in naturally infected palms, and the two fungi were reisolated from the necrotic tissues in every instance. The name 'decline disease' lacks precision and the author, following the suggestion of H. S. Fawcett, proposes the name '*Omphalia* root rot' for the disease of date palms caused by the two species of *Omphalia*.

Wallace (G. B.). **Report of Plant Pathologist.**—*Rep. Coffee Res. Exp. Sta., Lyamungu, Moshi, 1938*, pp. 26–29, 1940.

Discussing the results of fungicide tests in the control of coffee leaf disease (*Hemileia vastatrix*) in Tanganyika described in the previous report [*R.A.M.*, xviii, p. 21], the author states that the crop was found to vary considerably from tree to tree, plot to plot, and also from year to year under any one treatment, so that crop counts would require to be taken over several years. The more promising method of taking records is to make monthly counts of fallen leaves from about 15 trees under each treatment. In the 1937 experiments the figures for leaf fall from August to December were: control 14,175, 1 per cent. Bordeaux 6,143, 0·5 per cent. Bordeaux 6,909, and copper hydroxide 12,616. Total leaf fall occurred earlier in the control and copper hydroxide plots than in either of the Bordeaux series. In the 1938 experiment the leaf fall figures were: controls 6,465 and 7,125; 1 per cent. Bordeaux 1,659, and cuprous oxide 3,827. Leaf fall did not occur earlier in the control plots in this experiment. Leaves formed after spraying appeared to be longer-lived and less diseased than those on untreated trees. The *Hemileia* infection in the experimental plots was so low that its control could not entirely explain the differences in leaf fall, and it is thought that the copper in the fungicides exercised a tonic effect on the plants.

Coffee trees growing on land with a western aspect were observed in February, during a very hot and dry season, to show die-back, 56 out of 389 trees being affected. The symptoms differed from those of normal die-back [ibid., xiii, p. 114] in first affecting the twigs at the nodes, one or both sides of which turn brown or black with dark brown lines on the wood below. The leaves at these parts also turn brown, hang down, and soon drop. When the disease has affected the entire twig, the distal parts wither and die. Several fungi were isolated from the diseased tissue, but none proved to be pathogenic in inoculation experiments. The disease is believed to be directly associated with intense sunshine during the early months of the year, and in some respects resembles 'Elgon die-back' described from Kenya [ibid., xviii, p. 438].

A visit to the Babati and Oldeani districts revealed the presence there of the following coffee diseases: *H. vastatrix* occurs on some plantations; *Cercospora coffeicola* [loc. cit.] and a yellowing of the leaves, both rather common, appear to be associated with cold winds at the higher elevations and may be controlled to some extent by the provision of windbreaks.

Armstrong (G. M.), MacLachlan (J. D.), & Weindling (R.). **Variation in pathogenicity and cultural characteristics of the Cotton-wilt organism, Fusarium vasinfectum.**—*Phytopathology*, xxx, 6, pp. 515–520, 1 fig., 1 graph, 1940.

Thirteen monospore cultures of *Fusarium vasinfectum*, the agent of cotton wilt, grown on potato dextrose agar at 28° C. at the South Carolina Agricultural Experiment Station in 1937, gave rise after varying periods to variants generally characterized by sparser aerial mycelium and a slower growth rate than the parent strains. No case of reversion to the parental type was observed during 17 successive transfers, and in fact the mutants, which in their turn may produce secondary variants, tended to predominate over the parents, even to the exclusion of the latter.

In soil inoculation experiments with 14 isolates of *F. vasinfectum*, of which four were variants, pathogenicity was to some extent correlated with profuse mycelial development and rapid growth, while lengthy maintenance in culture (for up to six years) caused a reduction of virulence. Two of the four saltants included in the trials were markedly less virulent than their parents, the others not deviating so sharply from the type. A much higher degree of resistance was shown by the Dixie Triumph 12, Super Seven, and Semiwilt varieties than by Farm Relief 2, but the fungus was reisolated from a large number of plants showing neither internal nor external symptoms of infection. It is considered possible that variants of *F. vasinfectum*, differing in pathogenicity to cotton, may occur in the field.

Watkins (G. M.) & Watkins (Matilde O.). **Experimental Phymatotrichum root rot of Retama and Corn.**—*Bull. Torrey bot. Cl.*, lxvii, 6, pp. 489–501, 27 figs., 1940.

In further studies on the cotton root rot fungus, *Phymatotrichum omnivorum* [*R.A.M.*, xix, p. 147], retama (*Parkinsonia aculeata*) and maize plants, which are considered immune from the disease at maturity under field conditions, were successfully inoculated with pure cultures of the organism in the seedling stage *in vitro*. A histological examination of infected plants showed that the process of infection is closely similar in both species. The cells of the host plant, from the epidermis inward, collapse and disintegrate, the cell walls becoming very thick and distorted in advance of the actual penetration by hyphae. Concurrently with this process individual hyphal tips may enter the lumina of cells of which walls have begun to break down, this being more often observed in maize than in retama. In the advanced stage the vascular cylinder is permeated with the mycelium. In the early stages of infection the nuclei and cytoplasm remain normal for a longer time than has been observed in cotton plants, but there was no evidence of the formation of special structures or tissues to inhibit invasion by the mycelium.

Greathouse (G. A.) & Rigler (N. E.). **The chemistry of resistance of plants to Phymatotrichum root rot. V. Influence of alkaloids on growth of fungi.**—*Phytopathology*, xxx, 6, pp. 475–485, 1940.

Continuing their studies at the Texas Agricultural Experiment Station on the chemistry of resistance to *Phymatotrichum omnivorum* in

plants [*R.A.M.*, xix, p. 470], the writers tested the influence on the growth of the fungus of 62 different alkaloids from 50 to 70 species belonging to 15 families varying in their reactions to the pathogen. Sanguinarine was found to be the most toxic of the substances investigated, completely inhibiting the development of *P. omnivorum* on a synthetic nutrient solution at a concentration of 2·5 p.p.m., followed by chelerythine, lycorine, oxyacanthine, delphinine, berbamine, and berberine [ibid., xix, p. 518] in the other named. In similar tests with six alkaloids on *P. omnivorum*, *Sclerotium rolfsii*, *Ophiobolus graminis*, *Armillaria mellea*, *Rhizoctonia* [*Corticium*] *solani*, *Fusarium vasinfectum*, and *Verticillium albo-atrum* it was found that the fungi showed increasing ability to tolerate alkaloids, usually in the order given, whilst the order of decreasing potency was as follows: sanguinarine, delphinine, berberine, gramine and solanine, and veratrine.

Generally speaking, the relative toxicity of the alkaloids to *P. omnivorum* corresponds with the relative rating for resistance of the plants from which they were isolated, indicating that their presence in the roots constitutes an important factor in ability to withstand infection.

Steinhaus (E. A.). **The microbiology of insects with special reference to the biologic relationships between bacteria and insects.**—*Bact. Rev.*, iv, 1, pp. 17–57, 1940.

This is a comprehensive review, followed by a ten-page bibliography, of outstanding contributions to various aspects of the microbiology of insects, including the fungal flora of the intestinal tract, yeasts and moulds as food [cf. *R.A.M.*, xix, pp. 405, 471, *et passim*] and as enzyme-producing auxiliaries in the digestive process, and the nature, function, and transmissibility of intracellular micro-organisms (mycetomata) [ibid., xiv, p. 306].

Drechsler (C.). **Three fungi destructive to free-living terricolous Nematodes.**—*J. Wash. Acad. Sci.*, xxx, 6, pp. 240–254, 3 figs., 1940.

Continuing his studies on the fungal parasites of nematodes in decayed plant remains and leaf mould in the United States [*R.A.M.*, xviii, p. 798; cf. also xix, p. 472], the writer fully describes [with Latin and English diagnoses] two new monotypic genera, of which the type species are *Haptoglossa heterospora* and *Meristacrum asterospermum*, as well as a feebly predaceous undetermined species of *Cephalosporium*.

Smith (C. E.). **Epidemiology of acute coccidioidomycosis with erythema nodosum ('San Joaquin' or 'Valley fever').**—*Amer. J. publ. Hlth*, xxx, 6, pp. 600–611, 3 graphs, 1 map, 1940.

This is a useful survey of the information available to date concerning the following aspects, among others, of the benign 'San Joaquin' or 'Valley fever' or 'desert rheumatism' (*Coccidioides immitis*) in California [*R.A.M.*, xix, p. 537]: incubation period, source and mode of transmission, seasonal distribution, and extent of coccidioidomycosis. The endosporulating spherules of the fungus do not appear to pass directly from host to host, infection being acquired through inhalation of the chlamydospores.

Stewart (R. A.) & Kimura (Frances). **Studies in the skin test for coccidioidal infection. I. The preparation and standardization of coccidioidin.**—*J. infect. Dis.*, lxvi, 3, pp. 212–217, 1940.

A simple method for the preparation of coccidioidin is described and a table given showing the results of skin tests on four patients suffering from infection by *Coccidioides immitis* [*R.A.M.*, xix, p. 153 and preceding and next abstracts]. Doubts are expressed concerning the adequacy of the generic concept of *Coccidioides* and the specific name of *immitis*: it is quite possible that more than one species of the fungus is concerned in the immunological problem.

Hansel (F. K.). **Hay fever. The value of daily atmospheric counts of pollen grains and mould spores in diagnosis and treatment.**—*J. Mo. med. Ass.*, xxxvii, 6, pp. 241–246, 3 graphs, 1940.

The following fungi are stated to be of primary importance as incitants of allergy in persons liable to hay fever in the St. Louis district of Missouri [cf. *R.A.M.*, xix, p. 473]: *Alternaria*, *Hormodendrum* or *Cladosporium*, *Helminthosporium*, [unspecified] rusts and smuts, *Aspergillus fumigatus*, *Cephalothecium* [*Trichothecium*] *roseum*, *Mucor*, *Penicillium rubrum*, and *Monilia sitophila* [ibid., xix, p. 152]. Daily atmospheric counts of ragweed (*Ambrosia* spp.) and other pollens and of these fungal spores are of indispensable value in the diagnosis and treatment of the disorder during the hay fever seasons, of which there are three in the locality under observation. Among 194 patients tested by C. H. Eyermann (personal communication) for mould sensitivity, 21 per cent. gave positive reactions. Thirty-five per cent. of hay fever patients reacted positively to moulds (mostly *Alternaria*).

Vaughan (J. B.) & de Kay (H. G.). **A study of athlete's foot and its control.**—*J. Amer. pharm. Ass.*, xxix, 6, pp. 260–263, 2 graphs, 1940.

With a view to arresting the spread of 'athlete's foot' (*Trichophyton rosaceum*) [*R.A.M.*, xviii, p. 178; xix, p. 216] in the gymnasia and swimming pools of Purdue University, Indiana, the authors carried out a series of laboratory experiments to determine the toxicity to cultures of the fungus on Sabouraud's medium of various chemical compounds, of which sodium hypochlorite [ibid., xii, p. 509] gave the best results, inhibiting growth in 20 seconds at concentrations ranging from 0·1123 to 0·9512 per cent. The introduction of 13 gals. of 1 per cent. (available chlorine) of the disinfectant into foot baths with a capacity of 25 gals. proved very satisfactory as a prophylactic.

Lewis (G. M.) & Hopper (Mary E.). **Cultural variations of Trichophyton purpureum (Bang), with a discussion of the recognizable features.**—*Arch. Derm. Syph., Chicago*, xli, 5, pp. 895–903, 6 figs., 1940.

From studies extending over a three-year period in New York on more than 200 freshly isolated strains of *Trichophyton purpureum* [*R.A.M.*, xix, p. 473] on three different synthetic agar media (containing dextrose or maltose and peptone), the writers conclude that the apparent cultural differences do not invalidate the uniformity of the

species as a whole. Sectors developed in five of the strains under observation. Microconidia (predominating in fluffy colonies) are produced in or along the mycelium as sporiferous hyphae. Fuseaux are abundant in granular colonies. A reduction in the nutrient content of the medium results in the development of racquet mycelium and chlamydospores.

T. purpureum Bang (with which *Epidermophyton rubrum* Cast., *T. rubidum* Priestley, *T.* A. and B. Hodges, *T. purpureum* Ota, *Sabouraudites rubra* Ota & Langeron, and *T. plurizoniforme* are regarded as synonymous) is placed, on the basis of clinical investigations on five cases of folliculitis, in the ectothrix group.

Agress (H.) & Gray (S. H.). **Histoplasmosis and reticuloendothelial hyperplasia.**—*Amer. J. Dis. Child.*, lvii, 3, pp. 573–589, 6 figs., 1939.

This detailed record of a generalized case of histoplasmosis (*Histoplasma capsulatum*) [*R.A.M.*, xix, p. 557] in a seven-months-old male infant at the Jewish Hospital, St. Louis, Missouri, is accompanied by three tables summarizing (1) clinical, (2) gross pathologic, and (3) microscopic observations in seven (including the present) well-attested reports of the disease.

Clemens (H. H.) & Barnes (M. L.). **Histoplasmosis of Darling : report of a case.**—*Sth. med. J.* (*J. sth. med. Ass.*), xxxiii, 1, pp. 11–15, 8 figs., 1940.

Histoplasma capsulatum [see preceding and next abstracts] was isolated immediately after autopsy from the spleen of a 33-year-old coloured woman at the Louisville (Kentucky) City Hospital in the form of Gram-negative, yeast-like elements surrounded by thick, colourless capsules, 1·5 to 4 μ in diameter, and grown on 5 per cent. rabbit blood agar, on which a fine growth of small, grey, lustreless, confluent colonies began to develop after four days.

Williams (R. H.) & Cromartie (W. J.). **Histoplasmosis : report of a case.**—*Ann. intern. Med.*, N.S., xiii, 11, pp. 2166–2171, 1940.

The writers describe a case of histoplasmosis (*Histoplasma capsulatum*) [see preceding abstracts] associated with chronic lymphatic leucaemia in a 56-year-old farmer in Tennessee. The pathogen was present in many lymph nodes and also in the pharynx and epiglottis, the two latter being new sites of infection. The nodes were occupied by areas consisting of large, mononuclear cells which contained numerous small, oval or circular bodies, 0·5 to 2 μ in diameter, enveloped in refractile, non-staining capsules.

Mickle (W. A.) & Jones (C. P.). **Dissociation of Candida albicans by lithium chloride and immune serum.**—*J. Bact.*, xxxix, 6, pp. 633–646, 3 pl., 1940.

Eighteen freshly isolated strains of *Candida albicans*, 14 from the vagina and 4 from the sputum, were cultured at the Duke University Hospital, North Carolina, at 37° C. on Sabouraud's broth containing 0·25 per cent. lithium chloride and five also on the same medium plus 3 per cent. immune rabbit serum to induce dissociative changes [*R.A.M.*,

xix, p. 344]. Transfers were made every 48 hours and Sabouraud's and blood agar streaked at each transfer until rough colonies appeared.

Dissociation occurred in 14 out of the 18 strains studied. Individual colonies on Sabouraud's agar plates were greyish-white, creamy, rounded up, and surrounded by regular margins. The rough forms were white, flat, dry, and somewhat larger than the smooth ones, with a general resemblance to *C. krusei*. On blood agar an intermediate type of colony was also distinguishable, white and creamy with stellate margins: on transference to Sabouraud's agar it produced a creamy growth identical with that of the smooth forms. On blood agar the rough colonies appeared as dull grey, thin, spreading growths with irregular borders, becoming detached from the surface of the medium on transference. In Sabouraud's broth the smooth forms produced a homogeneous sediment in the bottom of the tube, the supernatant fluid remaining relatively clear. On the other hand, the rough forms made only scanty growth in the bottom of the tube but developed a pronounced 'veil' similar to that formed by *C. krusei*, extending 5 to 6 mm. above the surface of the broth after 24 hours.

On Sabouraud's agar the smooth strains appeared as round or slightly oval budding cells, whereas the rough forms were elongated or assumed bizarre shapes, often suggestive of mycelial hyphae. Maize meal agar slide cultures of the smooth strains showed a well-developed mycelium with numerous chlamydospores, frequently in clusters, at the ends of the branches. The mycelium of the rough forms was brush-like, with groups of elongated blastospores and large numbers of filiform, septate hyphae, but no chlamydospores.

Both the smooth and rough forms produced acid and gas in glucose and maltose, acid only in sucrose, and failed to ferment lactose.

Intravenous injections of all the smooth strains were lethal to rabbits in two to five days, whereas the rough forms were nonpathogenic in doses ten times as large. Subcutaneous injections of suspension of the smooth forms induced localized abscesses with erythema and the formation of hard nodules in four days, while little or no reaction followed infection with the rough strains.

It is concluded that the variants under observation were true rough phases of *C. albicans* analogous to bacterial dissociants.

Fowle (L. P.), Legault (R. R.), Heritage (Naomi), & Delluva (Adelaide M.). **Perianal moniliasis and associated pruritus ani cured by specific desensitization.**—*J. invest. Derm.*, iii, 3, pp. 193–203, 1940.

Full particulars are given of three cases of perianal moniliasis in male patients caused, respectively, by *Monilia* [*Candida*] *albicans*, *M.* [*C.*] *parapsilosis*, and *M.* [*C.*] *stellatoidea* [*R.A.M.*, xix, p. 535], and all responding favourably to specific desensitization with extracts of the fungi concerned (except that *C. albicans* was successfully substituted for *C. stellatoidea* in the third).

Houston (B. R.). **Botrytis blight of Flax in California.**—*Plant Dis. Reptr*, xxiv, 11, pp. 213–214, 1940. [Mimeographed.]

On 3rd April, 1940, Punjab flax plants grown in Fresno County,

California, which had reached the growth stage when most of the capsules were about two-thirds of their mature size, were found to be infected by *Botrytis cinerea* [*R.A.M.*, xix, p. 21], not before recorded on this host in the United States. Many of the capsules showed blighting characterized by a light tan colour, infection frequently extending for several inches down the branch bearing the affected capsule. The main stems of several of the plants were girdled by brown lesions ranging from a fraction of an inch to several inches in length. The condition was most severe in fields planted very early. It appeared that the early-planted flax had blossomed towards the end of February, when there was an exceptionally prolonged period of dull, wet weather, while the later-planted fields were in bloom during a relatively dry spell. The losses in the early and late fields were from 10 to 25 per cent. and from a trace to 5 per cent., respectively. The evidence showed that infections originated in old petals.

MACKIE (W. W.). **Botrytis cinerea in California Flax fields.**—*Plant Dis. Reptr*, xxiv, 11, pp. 214–215, 1940. [Mimeographed.]

The outbreak of *Botrytis cinerea* on Punjab flax in Merced, Fresno, and Madera Counties, California, in April, 1940 [see preceding abstract], appeared to be favoured by morning fogs. The advent of a three-day period of north wind arrested the spread and progress of infection, but only after some fields had suffered estimated damage of 50 per cent. Growers stated that the disease appeared in 1938, when there was also a wet spring.

MOORE (W. C.). **New and interesting plant diseases.**—*Trans. Brit. mycol. Soc.*, xxiv, 1, pp. 59–63, 1 pl., 1940.

The following notes relate to material examined in 1939 at the Ministry of Agriculture's Plant Pathological Laboratory, Harpenden [cf. *R.A.M.*, xviii, p. 400]. A severely diseased plant of *Lobelia syphilitica* var. *nana* from a Maidenhead nursery bore irregular, pallid spots, spreading inwards from the leaf margins or tips and surrounded by fairly broad, indefinite, pink to mauve-pink borders. Numerous black, ostiolate pycnidia of a *Septoria* apparently identical with *S. lobelia* Peck, 75 to 105 μ in diameter, were scattered in small groups over the affected leaves, many of which had been killed; the pycnospores were filiform, straight to slightly curved, with rounded ends, 18 to 30 by 1 to 1·5 μ (average length 23 μ).

Campanula raineri in the same nursery was also attacked by a species of *S.* causing a brown, coalescent blotching of the leaves, which were destroyed. The affected areas bore numbers of scattered or aggregated black pycnidia, 60 to 105 μ in diameter, with a well-marked ostiole up to 24 μ across, containing straight to more or less curved, hyaline, non- to triseptate spores with rounded ends, 17 to 38 by 1·5 to 3 μ (average length 27 μ). The species with which the foregoing appears to agree most closely is *S. obscura* Trail, found on living *C. rotundifolia* leaves in Great Britain in 1889.

Dead stems, petioles, leaves, and flowers of *C. betulaefolia* and leaves of *C. raineri* were found to be invaded by *Ascochyta bohemica* Kab. & Bub., not hitherto known in Great Britain. The hyaline, continuous to

uniseptate, uni- to pluriguttulate pycnospores measured 12 to 21 by 4 to 6 μ (average length 18 to 19 μ).

Since the first report on the *Pythium* rot of forced tulips [ibid., xvii, p. 246] the disease has been observed under glass on the varieties Prof. Rauwenhof (Hants, 1938), Allard Pierson (Lincs., 1938), and William Copland (Middlesex, 1939). The importance of a high soil moisture content in the development of infection was demonstrated by observations in a large Essex nursery, in which some 60,000 boxes of commercial varieties, practically waterlogged by heavy autumn rains, showed typical symptoms of the disease in many of the plants. Infection was arrested by the removal of the boxes indoors and the provision of dry conditions. Severely infected bulbs were brown, soft, and rubbery, or reduced to a shiny, dirty yellow mass. In milder cases the internal parts were white and sound, while the outer fleshy scales were wet, soft, sticky, of a dull white or pale yellow-brown colour, a well-marked, yellow or brown line frequently marking the division between the healthy and diseased areas. In slight attacks the basal plate and young bud within the bulb were partly or completely rotted. *Penicillium* and *Fusarium* spp. were sometimes found in profusion on the outer scales in the later stages of decay, but *Pythium* was the only constant concomitant of the rot. Of the two strains isolated in pure culture one exhibited the typical features of *P. ultimum*, while the other produced no fructifications and therefore could not be identified, though it resembled the form previously observed in England under glass [loc. cit.], its conidia being slightly smaller (average 21 to 28 μ in diameter) than those of *P. ultimum*. Inoculations with one or other of these two strains on 12 wounded Prince of Orange bulbs resulted in the development of typical symptoms on all in a moist atmosphere at 22° C.; under dry conditions at 7° to 14° only 4 out of 10 became diseased, three slightly. Infection was rapidly checked in mild or moderate cases by placing the bulbs in cool, airy sheds, but the outer scales, and sometimes the interior also, assumed a chalky aspect characteristic of the final stage in a series of changes induced by various parasitic or physiological factors [ibid., xix, p. 153] and once before, in 1938, observed in the same nursery in association with *Pythium*.

HONEY (E. E.). **Monilinia causing a brown rot and blight of the common Azalea.**—*Phytopathology*, xxx, 6, pp. 537–538, 1940.

Latin and English diagnoses are given of *Monilinia azaleae* n.sp., a parasite of the common azalea (*Rhododendron roseum*) in central New York [*R.A.M.*, xv, p. 531] and of *R. canescens* (collected by J. Miller) in Georgia. The stipitate cyathoid to patelliform apothecia, with a cinnamon-brown through Prout's brown to brown-black disk, attain 0·83 to 3·5 cm. in height at maturity and arise singly or in couples from the outer surface of the pseudosclerotium in mummified capsules; the smooth, slender, cylindrical stipe measures 0·4 to 3 cm. by 0·5 to 2 mm., and from its basal portion a conspicuous, blackish, capilliform rhizoidal tuft radiates fanwise; the expanding disk becomes cyathoid, later infundibuliform, and ultimately patelliform, 0·2 to 1·4 cm. in diameter; the cylindrical to clavate asci, 178 to 258 by 11 to 16·5 (average 213 by 13·8) μ, contain eight hyaline, elliptical spores, 9 to 20 by 5 to 14 (13·9

by 9·5) μ, usually arranged obliquely and biseriately in the upper end of the ascus; the numerous filiform, hyaline, non- to biseptate paraphyses, are about the same length as the asci; the continuous, limoniform, hyaline conidia, 8·5 to 19 by 5·5 to 14·5 (12·4 by 9·6) μ, are borne in long, di- and trichotomously branched chains and are separated at maturity by small, fusiform disjunctors. Pseudosclerotia develop in the infected capsules, filling the loculi with a solid mass of thick-walled, hyaline hyphae, assuming a palisade-like arrangement at the point of contact with the wall of the pericarp and the dissepiments. Capsules containing pseudosclerotia do not open but fall to the ground, where they overwinter in the leaf mould under the shrubs and may give rise in the following late April or early May to the apothecial stage. The conidia attack the leaves and succulent shoots when the host is in full bloom in early June, and are common on the young capsules later in the same month and in July.

Biraghi (A.). **Osservazioni e considerazioni su 'Tuberculina sbrozzii' Cav. et Sacc. associata a 'Puccinia vincae' Berk.**—[Observations and considerations on *Tuberculina sbrozzii* Cav. & Sacc. associated with *Puccinia vincae* Berk.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 1, pp. 71–80, 5 figs., 1940.

In the spring of 1938 the author observed periwinkle [*Vinca*] leaves infected by *Puccinia vincae* [*R.A.M.*, ix, p. 602] and also showing the presence of the conidia and sporodochia of *Tuberculina sbrozzii*. Two years' observations showed that the pycnidia of *P. vincae* alone appeared first, next sporodochia of *T. sbrozzii*, and later on, as these fructifications ceased, immature uredosori and teleutosori. As the uredospores and teleutospores appeared, conidial production by *T. sbrozzii* declined, and in time fructifications of this fungus became very difficult to find. The evidence is considered to indicate that *T. sbrozzii* is a true parasite of the periwinkle and not of *P. vincae*, though probably needing the presence of the latter for its development.

Davis (W. H.). **New stages of Sporocybe azaleae.**—*Phytopathology*, xxx, 6, pp. 506–514, 1 pl., 1 fig., 1940.

In further studies at the Massachusetts State College on the life-history of *Sporocybe azaleae*, the agent of *Rhododendron* bud and twig blight [*R.A.M.*, xviii, p. 682], the fungus, which was cultured on potato dextrose agar and other media at 22° C., was found to pass through the mycelial, chlamydosporous, cephalosporous, penicilloid, and coremial stages, and probably the ascogenous also.

Hyaline to grey phialides, 12 to 30 by 2·5 and 1·7 μ at the base and apex, respectively, arising singly and vertically from horizontal, prostrate hyphae, bore at the apices only oblong to angular, hyaline to brown- or grey-tinted cephalospores, 5·1 to 9 by 2·5 to 4·2 (mean 5·5 by 3·5) μ, cohering to form a 'caput' or 'false head', 20 μ in diameter, but ultimately separating. Dark brown, penicilloid conidiophores, 60 by 3 to 6 μ, terminated in a dendritic 'caput' of 2 to 12 spreading, dichotomous branches each supporting an apical chain of unicellular, ovate to globose or slightly apiculate, brown conidia, 2·8 to 9 by 1·5 to 5 μ; this stage develops in cultures following the cephalospores and in nature on

decaying buds, flowers, and branches. The coremial stage mostly occurs on the infected terminal buds of the previous season or earlier and consists of a sepia synnema or stipe, 480 by 50 μ, originating from a sclerotium and consisting of parallel hyphae or conidiophores, entirely similar to those of the penicilloid stage, the free ends of which form a 'caput' measuring 106 μ in height and 188 μ in expanded width; the globose to ovate, ellipsoid, or oblong, dark brown to sepia coremiospores, 3 to 17 by 3 to 10 (mean 7·2 by 5·4) μ, are formed in chains of up to 9 at the tips of conidiophores in the 'caput'. The perithecia average 394·8 by 310·8 μ and are furnished with beaks 902·4 by 67 μ; these appendages, more than twice the height of the body, recall the similar structures in *Ceratostomella ulmi*, a relationship between which and *S. azaleae* has previously been suggested [loc. cit.]. The few ascospores contained in one of the perithecia measured 3·6 to 9 by 1·8 to 3·6 μ.

Jones (L. K.). **Fusarium leaf spot of Sansevieria.**—*Phytopathology*, xxx, 6, pp. 527–530, 2 figs., 1940.

Sansevieria zeylanica and its var. *laurentii*, growing under glass in the State of Washington, are subject to infection by *Fusarium moniliforme* [*Gibberella fujikuroi*], which was isolated on potato dextrose agar from the sunken, reddish-brown, yellow-bordered, roughly circular lesions, ½ to 1 cm. in diameter, on the leaves [*R.A.M.*, xvi, p. 537]; in some cases only one surface is involved, but in others the spots extend right through the leaf, and the centre shrivels and falls out. In inoculation experiments on *Sansevieria*, typical symptoms were produced by *G. fujikuroi* on both wounded and sound leaves. Spraying with 4–6–50 Burgundy mixture plus 0·5 per cent. penetrol [ibid., xvii, pp. 123, 685] gave good coverage and did not injure the host. Plant sanitation practices should aid in reducing infection.

Fischer (G. W.). **Two cases of haplo-lethal deficiency in Ustilago bullata operative against saprophytism.**—*Mycologia*, xxxii, 3, pp. 275–289, 4 figs., 1940.

Five collections of *Ustilago bullata* [*R.A.M.*, xviii, p. 441] on *Agropyron*, *Bromus*, *Elymus*, and *Festuca* spp. showed a haplo-lethal deficiency inhibiting saprophytic existence. About half the spores isolated from any promycelium developed into typical sporidial colonies, the remainder budding several times and then undergoing complete lysis. In four collections the lethal factor was sex-linked, 42 pedigreed monosporidial isolates being of the same sex phase. In the fifth collection the lethal factor was segregated independently of sex factors, both sexes being represented in the isolates not possessing the character.

Twenty-nine pedigreed monosporidial isolates of the five collections exhibiting the lethal factor were paired with 22 isolates from *U. nigra*, *U. bullata*, *U. hordei*, *U. levis*, and *U. avenae* not possessing it. Both sexes were equally represented in the 22 isolates, and when paired with these the 29 isolates (all but two of which were of the same sex) gave the same reaction as when paired with each other. Thus, from the four collections in which the lethal factor was sex-linked, the 23 isolates obtained were of the same sex, both when mated with each other and

with the 22 isolates of *U. bullata* and other species not possessing the lethal factor.

The haplo-lethal factors operate only against saprophytic growth. When chlamydospores of two of the collections possessing sex-linked haplo-lethal deficiency were used as inoculum, high percentages of infection resulted, showing that the lethal factor did not operate against infection; from data as yet unpublished the author considers that both sexes are necessary to infection.

The lethals being exhibited by about half the sporidia borne on any promycelium, they are probably borne on odd chromosomes, in four instances sex-linked and in one other case apparently independent of sex.

Sprague (R.). **Notes on Septoria scald of Vetch and Peas in Oregon.**—*Phytopathology*, xxx, 6, pp. 541–542, 1 fig., 1940.

Vetch (especially *Vicia sativa*) is stated to be subject to severe damage in Oregon from a stem rot or scald and leaf spot due to *Septoria viciae* West., which causes a purple to vinaceous cortical rot of the lower culm. Spotting and speckling extend up the stem and into the leaves, and after the late winter rains the lesions coalesce into large scorched areas, involving severe injury and reduction of seed yield. Infection is disseminated by means of rain-splashed pycnospores, which are of two types, macrospores (53 to 71 by 1·7 to 2·1 μ) and microspores (3·5 to 11 by 1·2 to 1·5 μ), the former being straight to curved or slightly sinuous, broadly filiform, mostly triseptate, with small oil drops in the cells, and the latter non-septate and bacillar-shaped. The Hungarian vetch [*V. pannonica*] is less susceptible than *V. sativa*. Austrian field peas in the same State also suffer severely from a cortical stem scald produced by *S. pisi*.

Crosier (W.) & Weimer (Dolores). **Some fungi associated with grass seed.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1939*, pp. 120–124, 3 figs., 1940.

The following fungi are listed in the descending order of their importance as occurring on seeds of grasses at Geneva, New York (the pure cultures being identified by J. E. Machacek of the Dominion Laboratory of Plant Pathology, Winnipeg, Manitoba): *Curvularia spicifera* [*R.A.M.*, xvi, p. 735], *Alternaria tenuis*, *Helminthosporium sativum*, *Fusarium moniliforme* [*Gibberella fujikuroi*], *F. culmorum*, *Epicoccum purpurascens*, and *Phoma glomerata* [ibid., xvi, p. 106]. The two last-named were found only on the glumes of ungerminated seeds and do not apparently infect normal seedlings. *A. tenuis* and *C. spicifera* are saprophytes occurring on many seeds, but usually not parasitic on growing plants. Seedlings of *Poa* spp., however, may be killed by the first-named fungus and sprouts of rough bluegrass [*P. trivialis*] and Canada bluegrass [*P. compressa*] by either of the two. Following seedling inoculation by atomizing spores over the plumules, *A. tenuis* was slightly pathogenic to seedlings of red fescue [*Festuca rubra*] and Kentucky bluegrass [*P. pratensis*], but not of redtop [*Agrostis palustris*], and *C. spicifera* to those of *P. pratensis* and *A. palustris* but not of *F. rubra*. *Fusarium culmorum* killed 20 per cent. of the seedlings in *F. rubra* but seemed not to infect

P. pratensis and *A. palustris*. *H. sativum* was very pathogenic to these three and a large number of other grasses.

CHILTON (S. J. P.). **The occurrence of Helminthosporium turcicum in the seed and glumes of Sudan Grass.**—*Phytopathology*, xxx, 6, pp. 533–536, 1 fig., 1940.

Out of 52 lots of Sudan grass (*Sorghum vulgare* var. *sudanense*) [*S. sudanense*] seed produced in ten States between 1936 and 1939, 21 (40 per cent.) were found at the United States Regional Pasture Research Laboratory, State College, Pennsylvania, to be infected by *Helminthosporium turcicum*, which occurred in the seed and glumes of 16 lots, in the former alone of two, and in the latter alone of three, the percentage of diseased seed and glumes ranging from 1 to 20 and 1 to over 50, respectively. Four out of the five seed lots produced in 1937 were infected (8 per cent. seed and 3 per cent. glumes) indicating that the pathogen can survive in stored material for two winters. One hour's sterilization of the seed in 1 in 1,000 mercuric chloride, preceded by a one-minute dip in 95 per cent. ethyl alcohol and followed by immersion in a saturated solution of sodium hypochlorite, reduced germination from 90·4 to 87·9 per cent. and the incidence of *H. turcicum* from 15·2 to 2·7 per cent., the corresponding figures for a three-hour treatment being 72·7 and 1·2 per cent., respectively, denoting that the organism is practically confined to the seed coat. The average germination percentages of 22 healthy and 13 infected seed lots were 83·5 and 75·5, respectively.

Other fungi isolated from *S. sudanense* seed included species of *Alternaria*, *Helminthosporium*, *Acrothecium*, *Oospora*, *Penicillium*, *Fusarium*, *Chaetomium*, and *Phoma*, the first-named being found in 70 per cent. of the seeds and 50 per cent. of the glumes in some lots. *Colletotrichum graminicola* was an occasional occupant of several lots and was present in over 50 per cent. of the seeds and glumes of one batch from Georgia.

WORMALD (H.). **Host plants of the brown rot fungi of Britain.**—*Trans. Brit. mycol. Soc.*, xxiv, 1, pp. 20–28, 2 pl., 1940.

Blossom wilt of fruit trees and ornamental shrubs of *Pyrus* and *Prunus* in the British Isles is stated to be caused by *Sclerotia laxa* (*Monilia cinerea*), and brown rot of pome and stone fruits and flowering shrubs by *S.* (*M.*) *fructigena* [*R.A.M.*, xiv, p. 367 *et passim*], the latter occurring exclusively in its imperfect phase while the ascigerous stage of the former has only once been observed. The use of the generic name *Monilia* in preference to *Sclerotinia* will thus be more readily intelligible [ibid., xix, p. 480].

M. cinerea f. *mali* [*S. laxa* f. *mali*] is a common and destructive agent of blossom wilt on apples, pears being less frequently affected by [*S. laxa*: ibid., x, p. 322; xiii, p. 33], which has only rarely been found on apple, pear, quince, and medlar fruits. *S. fructigena* is common on apple, pear, and quince and has been found in recent years to be generally more prevalent than *S. laxa* on stone fruits (plums [ibid., xvi, p. 759] and Morello cherries). Plums of the St. Julien and Black Bullace varieties appear to be particularly susceptible to *S. fructigena*, which also attacks the stored fruit [loc. cit.]; in 1939 only four out of over 70 diseased

Shepherd's Bullace fruits on a tree at the East Malling Research Station bore *S. laxa*, the rest being invaded by *S. fructigena*. Both species occur on peach and nectarine, but no definitive estimate of their relative prevalence on these fruits has yet been made.

Other hosts of *S. laxa* in England include *P. serrulata*, *P. tomentosa*, *P. pumila*, bird cherry (*P. padus*), almond, Dwarf Russian almond (*P. nana*), *Pyrus purpurea* [ibid., xv, p. 703], *P. elaeagnifolia*, *P. aria*, and *P. japonica*. Cross-inoculation experiments with *S. fructigena* from quince, apple, and plum gave positive results on apple, plum (Shepherd's Bullace), and apple and pear, respectively, while *S. laxa* from pear spurs infected apple flowers and plum fruits, and was also successfully conveyed from medlar leaves to apple flowers, from plum twigs to pear flowers, from plum and cherry fruits to Morello cherry flowers, from cherry fruits to pear, flowers producing typical blossom wilt in all cases, from apricot twigs to cherry fruit and flowers, from *P. tomentosa* twigs to apple, pear, and cherry fruits, from *P. japonica* twigs to apple, pear, and cherry fruits, and from *P. purpurea* twigs to plum fruits, with rapid brown rot of the fruit in every instance. Although corresponding cross-inoculation tests from fruit trees to flowering shrubs have not yet been carried out, it may be assumed that the presence of *S. laxa* on the former involves a risk of damage to the latter in gardens where they are cultivated for ornamental purposes.

McLarty (H. R.). **British Columbia uses boron for fruit.**—*Bett. Crops Pl. Food*, xxiv, 4, pp. 8–11, 37–38, 1940. [Abs. in *Chem. Abstr.*, xxxiv, 13, p. 4509, 1940.]

Manifestations of boron deficiency in apples may take the form of corky core [see next abstracts], drought spot [*R.A.M.*, xiv, p. 592], flat fruit, measles [ibid., xix, p. 352], or die-back; in pears and cherries of drought spot or die-back; and in peaches, plums, and prunes of die-back, all the disorders in question being aggravated by the excessive use of nitrogenous fertilizers. Four years after the application of boric acid to the soil a slight recurrence of the various troubles may be expected, necessitating a repetition of the treatment.

Magness (J. R.). **Control of internal cork of Apples by boron applications.**—*Penn. hort. Ass. News*, xvii, pp. 74–75, 77–80, 82, 1940. [Abs. in *Chem. Abstr.*, xxxiv, 13, p. 4511, 1940.]

Virtually complete protection against internal cork of apples [see preceding and next abstracts] was conferred for a minimum period of three years by the application to the soil surrounding 20-year-old trees of 1 lb. boric acid or $\frac{3}{4}$ lb. borax. In the eastern States, the McIntosh, Cortland, and Ben Davis varieties, followed by Rome Beauty and Jonathan, appear to suffer most severely from the disease, which tends to be more widespread in years of intense drought than in those with a normal rainfall. Under conditions of extreme boron deficiency, 'surface drought spot', a superficial discoloration of the fruit, may occur six to eight weeks after blossoming, and die-back of the terminal branches may also be observed.

Chittenden (E.) & Thomson (R. H. K.). **The effect of borax on the storage quality of Jonathan Apples.**—*N.Z. J. Sci. Tech.*, A, xxi, 6, pp. 353–356, 1940.

Previous investigations having shown that heavy top-dressings of borax adversely affected the keeping quality of Jonathan apples [*R.A.M.*, xvii, p. 462], further observations were made at the Cawthron Institute, Nelson, New Zealand, to determine the duration of these effects. The amounts of internal breakdown in the 1937–8 season after nine months in storage at 38° F. for the ½, 1, and 3 lb. per tree applications were 13, 16, and 56 per cent., respectively, compared with 4 per cent. for the controls, the corresponding figures for 1936–7 being 35, 57, 81, and 11, respectively. The incidence of fungal rots [unspecified] for the three borax treatments and controls in 1937–8 was 4, 4, 22, and 3 per cent., respectively, as against 6, 23, 41, and 1, respectively, in 1936–7. Analyses of the boron content of 1937–8 samples of the experimental fruit revealed the presence of 28, 42, 78, and 20 p.p. million for the ½, 1, and 3 lb. treatments and controls, respectively, correlated with breakdown percentages of 6, 9, 40, and 2 per cent., respectively, the corresponding figures for 1936–7 being 30, 80, 111, and 17 p.p. million and 21, 45, 71, and 7 per cent., respectively. Fungal rots in the three treated lots and controls in 1937–8 amounted to 4, 4, 22, and 3 per cent., respectively, compared with 6, 23, 41, and 1 per cent., respectively, in 1936–7.

In another series of experiments in two localities, factors other than boron content apparently played a decisive part in the development of breakdown in stored Jonathans, no deleterious effect on which, however, was exerted by the 0·10 and 0·25 per cent. borax sprays recently found to be helpful in the control of internal cork [ibid., xix, p. 416].

Wallace (T.) & Jones (J. O.). **Pot experiments on bitter pit of Apples.**—*Rep. agric. hort. Res. Sta. Bristol, 1939*, pp. 79–84, [1940].

Injection experiments with the salts of major and minor elements and citric acid on Bramley's Seedling apple trees growing in compost in pots showed that none of the treatments gave satisfactory control of bitter pit. Appreciable damage to the trees was caused by cobalt and nickel. In field tests boric acid and iron citrate failed to control bitter pit in apples and cork in pears [*R.A.M.*, xviii, p. 118].

Wallace (T.) & Jones (J. O.). **Boron in relation to bitter pit in Apples.**—*J. Pomol.*, xviii, 2, pp. 161–176, 1940.

The results of storage tests and chemical studies carried out at Long Ashton and in various orchards during 1935 and 1936 with apples of several varieties (mainly Bramley's Seedling) led to the conclusion that boron is not related to the bitter pit problem in England [see preceding abstract].

Kidson (E. B.), Askew (H. O.), & Chittenden (E.). **Magnesium deficiency of Apples in the Nelson district, New Zealand.**—*N.Z. J. Sci. Tech.*, A, xxi, 6, pp. 305–318, 4 figs., 1 graph, 1940.

Premature defoliation of Jonathan, Sturmer, and Cox's Orange apple

trees in the Nelson district of New Zealand has been identified as the final expression of magnesium deficiency [*R.A.M.*, xix, p. 545], earlier symptoms of which include a purplish or dark brown interveinal discoloration of the leaves, proceeding upwards from the base of the current season's leader growth and leaving only a tuft of green foliage at the tip. The Dunn's Favourite and Granny Smith varieties first develop chlorosis of the type ordinarily associated with magnesium deficiency in crop plants, necrotic areas later appearing between the veins.

The injection of 0·25 per cent. magnesium sulphate into the branches of affected trees gave excellent control of the trouble, slightly less satisfactory results being obtained with a mixture of this compound and calcium nitrate, while calcium acetate alone caused severe scorching. Analyses of leaf samples from injected Jonathan trees revealed a large increase in the magnesium content of the foliage, e.g., from 0·37 and 0·16 per cent., respectively, in the leader tip and older leader leaves to 0·63 and 0·48, respectively. A good correlation was established between leaf blotching and a low magnesium content of the foliage, severe symptoms occurring, for instance, in the presence of 0·37 and 0·16 per cent. of the element in the leader tip and older leaves, respectively, but not in that of 0·54 and 0·25 per cent., respectively.

Premature defoliation of apple trees was found to be most prevalent in conjunction with a liberal use of potassic fertilizers, high potash figures coinciding with a low magnesium content in leaf analyses, e.g., 1·72 and 2·21 per cent. potash and 0·37 and 0·16 per cent. magnesium in the leader tip and older leaves, respectively, of badly blotched trees. It is considered probable that heavy applications of potash manures on several acid leached soils of the Nelson district has induced an unfavourable ratio of available potassium to available magnesium in the soil, thereby reducing the intake of the latter by the trees.

[An account of this work also appears in *J. Pomol.*, xviii, 2, pp. 119–134, 2 pl., 1 graph, 1940.]

WALLACE (T.). **Chemical investigations relating to magnesium deficiency of fruit trees.**—*J. Pomol.*, xviii, 2, pp. 145–160, 1 pl., 1940.

Chemical investigations on foliage and soil samples from ten localities in England where symptoms of magnesium deficiency [see preceding abstract] occurred in 1939 on apples, plums, black currants, and gooseberries showed that foliar magnesium deficiency symptoms were invariably accompanied by a low magnesia status in the leaves. Where lime, magnesia, or potash was deficient in the leaves, the trees in all cases showed undesirable features in growth and foliage. Liming, together with application of a complete nitrogen-phosphorus-potash fertilizer or dung, still left magnesia low, and it would seem that special dressings are required to correct this condition. The evidence in one locality clearly demonstrated that the magnesia status of the plants was not significantly affected when they passed from a condition of potash deficiency, where magnesium deficiency was not apparent, to one of potash sufficiency, where magnesium deficiency became a serious matter. The data also indicated that a period of two or three seasons may be necessary to effect improvement by dressings containing magnesium. On acid soils where lime as well as magnesium is deficient, the best and

cheapest remedy will probably be a magnesium-rich magnesian limestone, while on acid soils deficient in magnesium alone neutral salts of magnesium should prove suitable.

In two experiments deficiencies in nitrogen, phosphorus, potassium, calcium, or magnesium increased the susceptibility of gooseberries in sand culture to lime-sulphur spray injury.

WALKER (E. A.). **Scab of Apples in storage.**—*Trans. Peninsula hort. Soc.*, xxix, 5, pp. 105–111, [?1940].

In studies conducted in Maryland of the development of scab (*Venturia inaequalis*) on stored apples [*R.A.M.*, xix, p. 353], over 11,000 Delicious and nearly 26,000 Williams's Early Red fruits from well-sprayed trees were examined at harvesting and the early scab lesions on them were found to be most numerous at the calyx end: 80 per cent. of those on Delicious and 73 per cent. of those on Early Red. At the end of four months' storage the number of lesions originally present showed under 1 per cent. increase, and the size of the pre-storage lesions had increased by 10 per cent.

Stayman fruits from sprayed trees were placed in cold storage and home cellar storage at 50° to 55° F. After two months, those in the home cellar began to show numerous black and brownish, smooth lesions under the cuticle; about 50, 40, and 10 per cent. of these lesions developed on the stem, middle, and calyx thirds of the fruits, respectively. This indicates that storage scab lesions develop most frequently on the stem end, and pre-storage ones most frequently on the calyx end of the fruit.

Stayman apples (wrapped in waxed paper) after seven months' storage in slatted wooden boxes showed only one-third as many storage lesions as similar wrapped fruits kept in pasteboard boxes.

It was observed that storage scab lesions differ so much from those appearing on the fruit at harvest time that they may be mistaken for some form of functional spotting or fungal spot. During storage pre-storage lesions grew in a spreading, irregular manner. The spreading, subcuticular margin was of two types, coal-black and regular, or brownish to black and rather irregular. On Stayman and Delicious fruits the cuticle above the lesions did not rupture. A second type of lesion appeared as small, brown or black, shiny areas under the cuticle, growing out underneath, but not rupturing the cuticle. A third kind of lesion was much smaller, and dull grey-black; the mycelial mat raised the cuticle at irregular intervals, causing the surface of the lesion to be rough to the touch, and sometimes slightly rupturing the cuticle.

MARSH (R. W.). **Notes on the use of certain sulphur preparations in Apple spraying.**—*Rep. agric. hort. Res. Sta. Bristol, 1939*, pp. 42–51, [1940].

During 1938 widespread reports were received at Bristol that injuries caused to apple trees by cold weather in spring were aggravated by the effects of lime-sulphur spraying. Attention was therefore directed to the possibilities of finding sulphur-containing sprays which would effectively control scab [*Venturia inaequalis*] without damaging the foliage. In one test seven-years-old Cox's [Orange Pippin] and Worcester

[Pearmain] trees were sprayed with 2 per cent. lime-sulphur on 2nd May and 1 per cent. on 6th June, alternate blocks being treated with ammonium polysulphide at the same concentrations and on the same dates. A block of unsprayed trees ran transversely through the sprayed ones. Both sprays were applied in large quantities at a pressure of 350 lb. per sq. in. On Worcester Pearmain trees the ammonium polysulphide, lime-sulphur, and no treatment gave, respectively, 5·1, 9·9, and 51·1 per cent. infection, while on Cox the corresponding figures were 2·2, 4·6, and 34·7 per cent. No spray damage was observed.

Estimates of mildew [*Podosphaera leucotricha*] infection on Cox's Orange Pippin trees treated since 1937 showed that in 1939 the unsprayed controls had 100 per cent. increased infection as compared with 1938; wettable sulphur (U.K.), hydrated lime, and casein (6–8–2–100 in April and 3–8–2–100 in June) gave 22 per cent. increase, lime-sulphur (3 gals. per 100 in April and 1 in June) 17, wettable sulphur (U.K.) and gelatine (6–1–100 in April and 3–1–100 in June) 9, and flotation sulphur cream (U.S.), 20 lb. per 100 in April, 10 in June, 6; while lime-sulphur, hydrated lime, casein, and cottonseed oil (3 gals., 8 lb., 2 lb., and 1 gal. per 100 in April, 1 gal., 8 lb., 2 lb., and 1 gal. per 100 in June) gave 14 per cent. decrease. The last-named treatment is too injurious for general use on Cox's apples.

When apple trees of ten commercial varieties were sprayed with (*a*) lime-sulphur 1 per cent., (*b*) an English ground sulphur wettable powder at 0·3 per cent., or (*c*) an American flotation sulphur paste at 0·3 per cent., no apparent spray damage resulted on Allington [Pippin], [Beauty of] Bath, Blenheim [Orange], Grenadier, Worcester Pearmain, or Bramley's [Seedling], while on Lane's [Prince Albert] the average yields per tree for the three treatments were 11, 54, and 71 lb., as compared with 209 lb. for the untreated trees, on Rival the corresponding figures were 40, 139, 105, and 389 lb., on Newton [Wonder] they were 171, 222, 230, and 551 lb., and on Cox 173, 111, 297, and 695 lb. In general, it is evident that circumstances favouring injury by lime-sulphur are also conducive to damage by sulphur pastes and powders, though these usually cause less injury than the first-named. Under English conditions, wettable and flotation sulphurs are useful where frequent summer applications are practicable, and should be regarded as adjuncts to the main scab control programme. There is no evidence to justify their use to displace lime-sulphur from the applications up to and including petal fall. The evidence indicates that colloidal, wettable, and flotation sulphurs are less injurious than lime-sulphur, but they are all able to damage sulphur-sensitive varieties. In conditions predisposing to spray injury any of these sulphur-containing products may cause serious leaf-shedding and fruit-drop. A correction of the conditions conducing to damage, such as nutritional deficiency, is likely to be of more value to growers than any weakening of the spray treatments to a point where adequate scab control becomes jeopardized.

Kearns (H. G. H.) & Martin (H.). **Spraying farm orchards in war time.**—*Rep. agric. hort. Res. Sta. Bristol, 1939*, pp. 35–41, [1940].

Spray programmes are laid down for the economical and effective control of the chief diseases and pests in different types of apple

orchards (newly planted, established cider, old farm, and mixed farm orchards), with notes on the materials and methods used, and costs.

Marsh (R. W.) & Swarbrick (T.). **Notes on the incidence of Plum bacterial canker in relation to methods of propagation.**—*Rep. agric. hort. Res. Sta. Bristol, 1939*, pp. 85–87, [1940].

Observations since 1928 have shown that in Worcestershire the plum variety most susceptible to bacterial canker [*Pseudomonas morsprunorum*: *R.A.M.*, xviii, p. 654] is Giant Prune; Victoria is only slightly less susceptible, but Pershore, though often attacked, is less frequently girdled and killed than either of the others. Observations indicate that in low-worked trees Kentish Bush is a satisfactory rootstock for Victoria and Giant Prune, the last-named being very resistant on this stock. Top-worked on to young Pershore trees Giant Prune makes satisfactory growth, but top-working of Victoria on to Pershore results in a tree wanting in vigour.

Hickman (C. J.). **The red core root disease of the Strawberry caused by Phytophthora fragariae n.sp.**—*J. Pomol.*, xviii, 2, pp. 89–118, 3 figs., 3 graphs, 1940.

An investigation of the red core disease of cultivated strawberries [*R.A.M.*, xviii, p. 809] begun at Westerham Hill, Kent, in 1938, showed that since its first occurrence in that district in 1935, the disease had spread to 50 fields. It also occurs in Hampshire, Somerset, Devon, and Cornwall. In Scotland, where it was first noticed in 1921, the disease has already severely crippled the industry. It is believed that the American red stele root disease [ibid., xix, p. 550] is similar to, if not identical with, that under investigation. The symptoms of red core appear in early or late summer. The plants cease to grow, remain dwarfed, and produce few or no runners and small leaves on short petioles; the foliage turns blue-green and becomes tinged with red, yellow, and brown. Ultimately the plants wilt and collapse. Less frequently they may wilt quite suddenly without noticeable previous symptoms. Affected plants bear no fruits or only a few undersized, dry, and useless ones. Sometimes recovery takes place after fruiting, but is only temporary. The disease attacks mainly the roots, the decay and death of which spread from the tips of main roots backwards, few lateral ones being produced. The external root symptoms may be not very conspicuous, the most characteristic being the red discoloration of the central vascular cylinder, which can be observed from late autumn to the spring. This discoloration can sometimes be found in roots which outwardly appear quite healthy. Young roots are particularly liable to attack.

The causal organism, which is described [with a Latin diagnosis] as a new species, *Phytophthora fragariae*, was isolated in pure culture, and its pathogenicity proved beyond doubt by inoculation with pure cultures of the fungus. Details are given of two sets of inoculation experiments; in the first the culture inoculum was added to the soil and infection took place in all the 24 plants inoculated, none of the controls being attacked. In a second experiment zoospores were used as the inoculum with similar results. Attempts to induce the fungus to attack living plants other than strawberry have so far failed. The fungus grew vigorously on Quaker

oat and French bean agars, but not on malt extract agar. The optimum temperature for development was 20° C.; there was no growth at 30° and very little at 4°, although the fungus appeared to be capable of withstanding temperatures below zero for short periods. The sexual organs developed sparingly in pure culture. The mycelium is hyaline, usually non-septate, and both inter- and intracellular; the terminal sporangia are borne on undifferentiated sporangiophores 10 to 800 μ long; they are usually inversely piriform, less commonly ovoid or ellipsoidal, non-papillate with a bluntly rounded apex, 32 to 90 by 22 to 52 (average 60 by 38) μ; they have thick walls with slight apical thickening and liberate zoospores, producing germ-tubes rarely. After the evacuation of a zoosporangium, further sporangia may be repeatedly formed (up to four times) from within the base, either within or protruding beyond the sporangium. Less often sporangia may also be formed sympodially on short lateral branches arising immediately beneath the original sporangium. Sexual organs develop most abundantly in the vascular tissue. Oogonia are terminal or lateral, commonly globose with a funnel-shaped base, 28 to 44 (average 39) μ in diameter, becoming golden-brown with age. The terminal or rarely intercalary antheridia are amphigynous or less commonly paragynous, measure 16 to 30 by 12 to 22 (average 22 by 16) μ, and are sometimes provided with short hyphal projections. The oospores are spherical, subspherical, or more irregular in shape and lie free within the oogonium; they measure 22 to 44 (average 33) μ in diameter when spherical, and are hyaline with a thick (3 μ), smooth wall.

In the earliest stage of infection seen in microtomed sections of roots the mycelium was present in the root cap and the vascular cylinder and cortex behind. No entry was apparent through the cortical tissues of the main root and it is believed that primary infection occurs through the root tips. In late spring and early summer, when the symptoms are developing in the aerial parts, the activity of the fungus ceases. It is then practically impossible to isolate the fungus and newly formed roots do not become infected. Secondary fungi may now mask the *Phytophthora*, species of *Pythium* and less commonly *Rhizoctonia* following the *Phytophthora* closely. The virulence of the fungi associated with root rots of the black lesion type [ibid., xiv, p. 179] is of a very low order compared with that of *P. fragariae*. In most varieties of strawberry the fungus is confined to the roots, but in some it advances into the rootstock. The disease is favoured by a high water content of the soil due to poor drainage. Some evidence was obtained indicating that the disease may be inhibited by soil alkalinity. In varietal tests none of the common varieties was immune, but Pillnitz, Early Cambridge, and Oberschlesien were fairly resistant and the immunity of four new seedling varieties from Scotland was confirmed. The spread of the disease to England is considered to be a very serious problem. The disease is undoubtedly transmitted from one locality to another by infected runners and the utmost care should be exercised to use only runners from healthy sources. It is believed to be impracticable to control the disease by means of eradication, crop rotation, or soil disinfection, but some hope is entertained of the possibility of combating it by the use of immune varieties.

Crowell (I. H.). **Rhizoctonia solani on Strawberries in transit.**—*Plant Dis. Reptr*, xxiv, 10, p. 207, 1940. [Mimeographed.]

A species of *Rhizoctonia* [cf. *R.A.M.*, xix, p. 26], presumably *R.* [*Corticium*] *solani*, was the only organism isolated from infected strawberries in a refrigerated car-lot shipment sent from Louisiana to Montreal. The berries were uniformly infected and showed symptoms very similar to those described for leather rot (*Phytophthora cactorum*) [loc. cit.].

Magee (C. J. P.). **Transmission studies on the Banana bunchy-top virus.** —*J. Aust. Inst. agric. Sci.*, vi, 2, pp. 109–110, 1940.

In this preliminary report of studies on the transmission of the banana bunchy top virus [*R.A.M.*, xix, p. 31] it is stated that attempts to transmit the disease by mechanical inoculations were unsuccessful. Positive results were obtained with individuals of both the winged and wingless adult forms of the aphid *Pentalonia nigronervosa* [ibid., xv, p. 592] and with each of their four nymphal stages, approximately 46 per cent. of the 233 individuals of all stages having transmitted the disease. Adult aphids fed on infected leaves transmitted the virus much less frequently than nymphal forms fed on the same inoculum. The virus was not transmitted by infective adults to their progeny (which is viviparous and agamic). Infection apparently occurred with minimal dosages of the virus, as an increase in the number of infective aphids affected only the frequency of infection and not the severity of symptoms or the minimum incubation period for the disease. The virus was transmitted by infective aphids after feeding periods on susceptible plants of not less than 1½ to 2 hours. For acquisition of the virus by nymphs a feeding period on the infected plant of not less than 17, but preferably 24 hours, was required. Temperatures of 10° and 15° C., by lessening the vitality of infective aphids and their inclination to feed, reduced the number of successful transmissions; this fact may be of importance in determining the low winter incidence of the disease. The aphids may retain their infectivity in daily transfers to fresh plants for as long as 13 days after removal from infected plants. Nymphs may carry the virus through their moults. Some length of time, varying individually from a few hours to about two days, elapses between the feeding on infected plants and the development of infective power. In infected leaves detached from plants and kept fresh the virus persisted for at least 12 days. Although the virus causes systemic infection, it is not found in every part of the infected plants, but only in the first-symptom leaf (and in this only in the green streaks and the vascular bundles showing abnormal phloem) and in leaves developing after infection.

Gonçalves da Silva (S.). **A antracnose do Caqui.** [Persimmon anthracnose.]—*Biologico*, vi, 5, pp. 125–126, 1940.

Persimmons in Brazil are reported to be liable to infection by *Colletotrichum gloeosporioides* [cf. *R.A.M.*, xi, p. 313], which produces on the fruits sunken, nearly black, pale-bordered lesions, attaining a diameter of 1 cm. or more and sometimes coalescing to form large necrotic areas. The entire pulp is invaded right through to the stone and converted into

a blackened, desiccated framework of fibres. Diseased fruits are unfit for consumption and are mostly shed prematurely. Masses of gelatinous, pink spores are formed in concentric zones on the older spots and conveyed by wind, water, or insects to healthy fruits. Control measures should include, in addition to routine practices of orchard sanitation, a spray schedule consisting of one winter application (after the pruning of the branches) of lime-sulphur (1 in 40) and three to four treatments at 15- to 20-day intervals during the growing period with 1 per cent. Bordeaux mixture. Preliminary observations indicate that the Mikado variety of *Diospyros kaki* is more resistant than the elongated fruit of an undetermined form, possibly a hybrid between *D. kaki* and *D. virginiana*.

McKee (R. K.). **Experiments on the control of Mango anthracnose by spraying.**—*Trop. Agriculture, Trin.*, xvii, 6, pp. 115–117, 1940.

Particulars are given of a three-year (1937 to 1939) spraying trial for the control of mango anthracnose (*Colletotrichum gloeosporioides*, the conidial stage of *Glomerella cingulata*) in Trinidad [*R.A.M.*, xvii, p. 403], the results of which showed 1 per cent. Bordeaux mixture to be very effective against the development of the fungus in stored mangoes of the Julie variety. In 1937 20 per cent. wastage of the fruits from treated trees sprayed weekly from flowering time until harvest occurred in 7·7 days, compared with 5·8 for the unsprayed controls, the figures for fruit from trees given two applications, sprayed for half the season, sprayed throughout the season, and unsprayed controls in 1930 being 5·5, 7·2, 8·5, and 5·3, respectively, and in 1939 6·7, 7·2, 7·7, and 5·7, respectively. The increase in storage time given by spraying the whole season should amount in good years to two days and in bad years to over three days. In 1939 even two sprays at flowering directed mainly against blossom blight gave a noticeable increase in storage time. Generally speaking, young fruit is more susceptible than mature to anthracnose, so that the most appropriate times for spraying would be about the flowering season, during which two treatments may be given, followed by an occasional application until half the full size is attained. In the exceptionally wet year of 1938, however, the end-of-season treatments were more successful than those given earlier. The beneficial effect of spraying in any one year was found to persist into the next.

Cunningham (G. H.). **Certification of therapeutants.**—*N.Z. J. Sci. Tech.*, A, xxi, 6, pp. 319–321, 1940.

A list (the sixth), dated February, 1940, is given of 31 fungicides and insecticides approved after rigorous laboratory and field tests by the Plant Diseases Division, Plant Research Bureau, New Zealand Department of Scientific and Industrial Research [*R.A.M.*, xviii, p. 235].

Howard (F. L.). **Chloropicrin, steam, carbon disulphide, and other treatments for the control of injurious soil microorganisms.**—*Rep. Veg. Gr. Ass. Amer., 1939*, pp. 115–130, 5 figs., 1940.

The chief feature of this report is a full account concerning the successful application of chloropicrin as a soil fumigant at the Rhode

Island Agricultural Experiment Station [*R.A.M.*, xix, p. 165], where it has been found effective against fungi causing disease and weed seed, as well as insects and eelworms.

CRONALL (H. E.) & OGILVIE (L.). **A note on the incorporation of growth promoting substances in seed dressings.**—*Rep. agric. hort. Res. Sta. Bristol, 1939*, pp. 100–102, [1940].

This is a condensed account of work fully described in a paper already noticed from another source [*R.A.M.*, xix, p. 322].

BERRY (W. E.). **Spray injury studies. Progress Report II. The effects of time and temperature on the production of hydrogen sulphide during atmospheric decomposition of lime sulphur.**—*Rep. agric. hort. Res. Sta. Bristol, 1939*, pp. 52–56, 1 graph, [1940].

After referring to his earlier investigations [*R.A.M.*, xviii, p. 750], which indicated that hydrogen sulphide production may play a part in lime-sulphur spray injury, the author describes an experiment carried out to determine the rate of hydrogen sulphide production when the wash was exposed to the action of air, by drawing air through it.

The [tabulated] results showed that the time elapsing before sulphur was deposited differed at different temperatures, but deposition always occurred shortly after hydrogen sulphide evolution had attained a maximum. It is concluded that when lime-sulphur is exposed to air, decomposition by carbon dioxide begins almost at once. Oxidation is at first retarded, but later predominates. As polysulphide and sulphide begin to be decomposed by oxygen, the amounts available for decomposition by carbon dioxide are rapidly reduced, and hydrogen sulphide production declines. With increasing temperature hydrogen sulphide production was expedited; the rates of oxidation and decomposition by carbon dioxide were increased, and the maximum rate of hydrogen sulphide production was thus reached earlier at higher than at lower temperatures.

The data indicate that, if hydrogen sulphide evolved from lime-sulphur is a factor in spray injury, it exerts its maximum effect very soon after spraying. In practice, a much larger surface of solution would be exposed to the atmosphere than was the case in the author's experiments, and the normal concentration of carbon dioxide in the air might be increased by the respiration of the leaves. The former condition would accelerate decomposition, while the latter would increase hydrogen sulphide production.

KEARNS (H. G. H.). **A simple connector for overland steel spray mains.**—*Rep. agric. hort. Res. Sta. Bristol, 1939*, pp. 57–59, 2 figs., [1940].

A description is given of a cheap, simple device to replace the unsatisfactory rubber connexions used with overland steel mains in orchard spray apparatus. Used successfully in long lengths of steel mains, it consists of two main parts, a hexagonal nut gunmetal bush and a gunmetal cap with a lining of B.S.P. red steam barrel nipple, fitted with a gunmetal collar at one end. Each steel main has a bush on one end, and a cap and lining on the other. The cost of converting existing types

of flexible connectors to the all-metal type amounts to 1*s.* 6*d.*, including materials and labour.

Wilcox (L. V.). **Determination of boron in plant material. An ignition-electrometric titration method.**—*Industr. Engng Chem., Analyt. Ed.*, xii, 6, pp. 341–343, 1 diag., 1940.

Full details are given of the electrometric titration method for the determination of boron in plant material. Experiments at the Rubidoux Laboratory, Riverside, California, have shown the technique to be eminently suitable for the low concentrations (in the range below 50 mg. per kg. of dry material) occurring in boron deficiency studies.

Johansen (D. A.). **Plant microtechnique.** First Ed.—viii+523 pp., 109 figs., London, McGraw-Hill Publishing Company, Ltd., 1940. 30*s.*

This manual is mainly concerned with histological methods and its specific aim is to enable students, instructors, and research workers to prepare their own microscope slides of plant materials. The text is divided into two sections, the first dealing with botanical technique in general and the second giving detailed directions for the treatment of special groups. Chapters on bacteria and fungi are included in the latter section.

Galloway (L. D.) & Burgess (R.). **Applied mycology and bacteriology.** Second Ed.—viii+186 pp., 21 figs., 1 diag., London, Leonard Hill, Ltd., 1940. 10*s.*

The second printing of this manual [*R.A.M.*, xvii, p. 262] has afforded an opportunity of revising the text and bibliographical references in the light of the most recent discoveries in the microbiological field.

Hansen (C.). **Formation of mould and fungi on paint films.**—*Paint Varn. Prod. Manuf.*, xx, 6, pp. 146–151, 1940.

In the course of this general survey of the conditions influencing the development of moulds on paint films in the United States [*R.A.M.*, xix, p. 553], the writer states that *Penicillium glaucum* is usually found in moist, shady situations, *Aspergillus flavus* is prevalent in breweries, and the brownish-red *Phoma* [ibid., xvii, p. 195] flourishes in hothouses. The use of a mixture of red seal lithopone paint and zinc oxide (2 to 3:1) is recommended for outside applications. Top-varnish coats should consist of oil-free materials. Infected wood requires a hard-drying disinfecting primer similar to ship bottom paints; under certain conditions, such as those prevailing in breweries, the base surface should be treated with mercuric chloride or thymol.

Weiss (F.). **Foreword to the revised check list of diseases of economic plants of the United States.**—*Plant Dis. Reptr*, xxiv, 7, pp. 140–148, 1940. [Mimeographed.]

In this foreword the author explains the scope and arrangement of the revised 'Check list of diseases of economic plants in the United States' now in preparation. The section dealing with *Abies* is given as a sample of the work and it is planned to present further sections from time to

time prior to the publication of the entire list. [The *Acer* section appears in *Plant Dis. Reptr*, xxiv, 10, pp. 190–201, 1940.]

WALLACE (J. C.). **Potato spraying or dusting in war time.**—*J. Minist. Agric.*, xlvii, 1, pp. 49–55, 1940.

Brief recommendations are given in popular terms for the control of potato blight [*Phytophthora infestans*] by the elimination of diseased tubers, the destruction of initial infection centres, spraying with fungicides, and the destruction of diseased foliage with sulphuric acid [*R.A.M.*, xvii, p. 131]. It is pointed out that proprietary dusts vary greatly in their copper content, which amounts to less than 10 per cent. in some and to 24 per cent. in others. Experiments over a period of years have shown that to secure good average control, the dust used should contain at least 15 per cent. metallic copper (or 18·75 per cent. copper oxide or 2·3 per cent. copper hydrate). In some years higher percentages gave significantly better results. At the start of the spraying season applications should be made at the rate of about 50 gals. spray or 10 lb. dust per acre, increasing to 100 gals. or 20 lb. when the plants are in full foliage.

FOISTER (C. E.). **Dry rot diseases of Potatoes.**—Reprinted from *Scot. J. Agric.*, xxiii, 1, 7 pp., 5 figs., 1940.

Apart from late blight (*Phytophthora infestans*), which may under certain conditions cause a dry decay of potato tubers simulating dry rot proper, the latter disease, or rather collective group of diseases, is associated in the British Isles with *Fusarium coeruleum* [*R.A.M.*, xviii, p. 409] and a species of *Phoma* [ibid., xvi, p. 272] responsible for 'gangrene', the symptoms of which are described in detail. Both dry rot and gangrene are essentially storage disorders and reduce the amount of healthy stock available for planting. Gangrened tubers, however, unlike those invaded by *F. coeruleum*, will yield a normal crop unless the bulk of the tuber, including the eyes, is involved in the soft-rot stage of the disease. *F. coeruleum* is known to be capable of persisting in the soil and infecting the tubers *in situ*, but it is not yet certain whether this also applies to the gangrene fungus. Dry rot is usually more severe on early varieties in sprouting boxes than on late ones in pits, although heavy infection may also develop under the latter conditions following opening for the dressing and dispatch of stocks, which permits the access to the tubers of the oxygen necessary for the spore germination in *F. coeruleum* and probably also in *P.* sp. In addition to soil contamination dry rot spreads from infected to healthy tubers, probably through the agency of mites and other pit, store, and shed insects, even under dry conditions. Other common sources of perpetuation, especially of *F. coeruleum*, are infested stores and boxes.

Symptoms of both dry rot and gangrene may appear as early as October, but most of the infection develops later in the season, becoming progressively more acute with the advance of maturity in the tubers from December and January onwards. Mechanical damage through any of the processes connected with lifting, storage, and transport is an important contributory factor in the development of dry rot, but gangrene is less dependent on injuries of this type as a mode of ingress.

Both *F. coeruleum* and *P.* sp. are most common and severe on early and second-early varieties, those chiefly affected being May Queen, Sharpe's Express, Duke of York, Catriona, and Di Vernon, while the former organism also attacks Ninetyfold and occasionally seriously damages Dargill Early, Arran Pilot, Arran Comrade, and Majestic (late), and the latter also occurs commonly on Arran Pilot, British Queen, and the later-maturing Ally, Doon Star, Great Scot, King Edward, and Majestic.

On the basis of these preliminary studies the following control measures are recommended; careful handling of the crop to avoid mechanical injury; storage in sprouting-boxes where the tubers, especially of early varieties, can be under constant observation, in a well-ventilated, cool place with sufficient light; disinfection of all boxes and of the entire storage room with formalin at a minimum strength of 5 per cent. before restocking with potatoes; burning of badly diseased tubers, those less severely infected serving as pig fodder after cooking; immersion of the tubers on lifting in a 0·1 per cent. solution of a standard organic mercurial compound or 1 per cent. formalin for 1 and ¼ to ½ minute, respectively; and (for seed tubers as a protection against dry rot) premature lifting and leaving the tubers to green on the field.

Endo (S.). **Studies on sclerotial diseases of the Rice plant in China. I. Morphology and pathogenicity of Sclerotium oryzae-sativae Sawada.**—*Ann. phytopath. Soc. Japan*, x, 1, pp. 7–15, 3 figs., 1940. [Japanese, with English summary.]

The dimensions of the sclerotia of *Sclerotium oryzae-sativae* [*Leptosphaeria salvinii*] collected on rice in southern China varied on potato decoction agar with the locality of origin, ranging from 267 to 1,666 by 267 to 1,200, 333 to 1,733 by 267 to 1,466, and 267 to 1,466 by 267 to 1,333 μ, respectively for the Amoy, Tan-kuei-t'sun, and Fui Sha Wei strains. The sizes of the cells composing the sclerotia of the three strains were 11·1 to 28·9 by 11·1 to 26·7, 11·1 to 24·4 by 11·1 to 22·2, and 13·3 to 28·9 by 11·1 to 28·9 μ, respectively. In inoculation tests on the leaf sheaths of the Miisinriki variety the strongest pathogenicity was exhibited by Fui Sha Wei and the weakest by Tan-Kuei-t'sun, Amoy being intermediate in this respect.

Van Hell (W. F.). **Het gebruik van kalk als kleurstof voor desinfectiemiddelen, die met water emulgeerbar zijn.** [The use of lime as a colouring agent for water-emulsible disinfectants.]—*Bergcultures*, xiv, 22, pp. 719–721, 2 figs., 1940.

Experiments having shown that slaked lime, commonly used as a colouring agent for izal, carbolineum, and other fungicides applied to the tapped surfaces of *Hevea* rubber trees in Sumatra, is quite unsuitable for this purpose, since it breaks up the emulsion and permits flocculation in the form of thick drops of tar oil, the writer recommends its replacement by white chalk, white clay, methylene blue, fuchsin, red ochre, or rhodamin B.

Ellis (M.). **Some fungi isolated from Pinewood soil.** *Trans. Brit. mycol. Soc.*, xxiv, 1, pp. 87–97, 1 fig., 1940.

Samples of soil (P_H 4) were collected in the early autumn from a Scots

pine (*Pinus sylvestris*) wood near Nottingham, material being taken from the side of a pit, 4 ft. deep, at depths of 4 and 10 in. and removed in sterile containers to the laboratory, Nottingham University College. Two modes of isolation were used, viz., Waksman's 'direct method' [*R.A.M.*, ii, p. 233], in which fragments of soil are placed directly on the medium and incubated for 24 hours at 22° C., and another involving the suspension of 10 gm. samples in 100 c.c. sterile water, with drops of which plates were inoculated and incubated for ten days at 22°. The media used for isolation were soil extract and glucose-peptone agars. The following species were isolated (total from both methods): *Botrytis cinerea*, *Mortierella hygrophila*, *M. gemmifera* n.sp. [a Latin diagnosis of which is given], *Mucor hiemalis*, (?) *M. sylvaticus*, *M. ramannianus*, *Rhizopus nigricans*, *Trichoderma koningi* [*T. viride*], *T. lignorum* [*T. viride*], *T. album*, *Zygorrhynchus moelleri*, *Absidia spinosa*, *Acrostalagmus cinnabarinus*, *Alternaria tenuis*, *Aspergillus sydowi*, *Penicillium cyclopeum*, and *P.* spp.

Most of the fungi enumerated have been found by other workers in the acid forest soils of temperature climates, of which they may, in fact, be regarded as typical [cf. ibid., xviii, p. 137 *et passim*]. There was little difference in the fungal population between the 4 and 10 in. samples.

Hoerner (G. R.) & Rabak (F.). **Production of Hops.**—*Fmrs' Bull. U.S. Dep. Agric.* 1842, 40 pp., 21 figs., 1940.

Popular notes are given (pp. 26–31) on the following diseases to which hops are subject and their control in the United States: downy mildew (*Pseudoperonospora humuli*), which may be combated by dusting with a copper sulphate-lime mixture (1:10) or spraying with a 4–4–50 zinc sulphate-lime solution plus 1 quart of rosin soap as a spreader; sooty mould, stated to be responsible for serious annual losses throughout the country, especially when the associated aphid penetrates the cones and thus permits the development of infection in the interior [cf. *R.A.M.*, viii, p. 16]; root rots, usually resulting from mechanical injuries and characterized by a dry decay and brownish or black discoloration of the diseased tissues; virus disorders; and powdery mildew [*Sphaerotheca humuli*], apt to cause heavy damage under favourable climatic conditions in New York and controllable by sulphur dusting or spraying.

Seaver (F. J.) & Waterston (J. M.). **Contributions to the mycoflora of Bermuda. I.**—*Mycologia*, xxxii, 3, pp. 388–407, 6 figs., 1940.

This annotated list of over 50 fungi collected in Bermuda by the senior author in the autumn of 1938 includes 10 new species. Among the new records is included *Agaricus* [*Psalliota*] *campestris*, observed to be well established in a field on Kitchener's (Hinson) Island.

Cummins (G. B.). **Uredinales of New Guinea.**—*Mycologia*, xxxii, pp. 359–375, 14 figs., 1940.

This annotated list of 34 species of Uredinales collected by Mrs. Mary Strong Clemens in Morobe District, New Guinea, comprises 20 new species, one new combination, and one new genus.

Thurston (H. W.). **The rusts of Minas Geraes, Brazil, based on collections by A. S. Müller.**—*Mycologia*, xxxii, 3, pp. 290–309, 1940.

This is an annotated list of 108 rusts (comprising six described as new) collected by A. S. Müller in Minas Geraes, Brazil.

Yamamoto (W.). **Formosan Meliolineae I.**—*Trans. nat. Hist. Soc. Formosa*, xxx, 200–201, pp. 148–158, 1940.

This is an annotated list of 33 Meliolineae [cf. *R.A.M.*, xiv, p. 532; xvii, p. 415] occurring (mostly on ornamentals) in Formosa, Japan. *Meliola butleri* is found on pomelo, *Citrus poonensis*, and *C. tankan* [ibid., ix, p. 64], and *M. mangiferae* on mango.

Waksman (S. A.). **On the classification of Actinomycetes.**—*J. Bact.*, xxxix, 5, pp. 549–558, 1940.

Details are given of a proposed classification of the order Actinomycetales [cf. *R.A.M.*, xix, p. 436].

Petch (T.). **Tubercularia.**—*Trans. Brit. mycol. Soc.*, xxiv, 1, pp. 33–58, 1940.

This is a critical study of the commoner British species of *Tubercularia*, the cultural work on which was carried out exclusively on oatmeal agar. The conclusion of Tulasne and Saccardo that *T. minor* is only a form of *T. vulgaris* is accepted, and an examination of the records and herbarium specimens of the remaining British species results in the reduction to synonymy with the latter of all but *T. versicolor*. *Nectria cinnabarina* is accepted as the ascigerous stage of *T. vulgaris*, *N. fuscopurpurea* and apparently *N. cinnabarina* var. *minor* being synonymous.

Petch (T.). **Xylaria.**—*Naturalist, Lond., 1940*, 779, pp. 153–156, 1940.

Evidence is briefly adduced to the effect that *Xylaria vaporaria* and possibly *X. tulasnei*, recently recorded as infesting cultivated mushroom [*Psalliota* spp.] beds [*R.A.M.*, xvii, p. 93] in England, are synonymous with *X. pedunculata*, *X. tulasnei* being a small form, with spores only half the size of those of *X. pedunculata* itself. Notes are given on other British species of the genus, the total number of which is reduced from 15 to 11.

Johnson (E. M.) & Valleau (W. D.). **Control of blackfire of Tobacco in Western Kentucky.**—*Bull. Ky agric. Exp. Sta.* 399, pp. 19–39, 6 figs., 1 diag., 1940.

In a comprehensive series of experiments carried out in western Kentucky from 1936 to 1939, Bordeaux mixture (3–3–50) sprinkled on tobacco beds with a watering pot, when the first true leaves appeared, and again 10 to 14 days later, in most cases completely prevented the development of wildfire (*Bacterium tabacum*) and angular leaf spot (*Bact. angulatum*), while blackfire (a late-season condition induced by either organism in association with wet weather and unsatisfactory soil conditions) [*R.A.M.*, xviii, p. 576; xix, p. 305] was prevented or delayed in fields set from the treated beds. In the few treated beds in which

these diseases did appear fewer than 12 affected plants per bed were found.

In 1936, 1937, and 1939, injury from blackfire to dark tobacco types in fields set from treated beds was slight, though up to 50 per cent. damage occurred in fields from untreated beds. In 1938, when heavy rain fell throughout the growing season, the average loss in fields from treated and untreated beds was 39 and 65 per cent., respectively.

Wildfire and angular leaf spot appeared in the field shortly after setting when present in the bed; the size and number of the spots gradually increased, and when rains were frequent or heavy, damage from blackfire rapidly ensued. In 1938 many fields that showed wildfire or angular leaf spot shortly after setting were destroyed by blackfire by mid-July, though fields from treated beds were only slightly affected even a month later.

Blackfire rarely occurs on fertile soils but is often epidemic on soils of low fertility; the condition can be readily induced in tobacco on infertile soil by inoculation with the two bacteria. In western Kentucky, where much damage is caused, over 80 per cent. of the fields are low in phosphorus and potassium. A system of soil management which builds up large reserves of available plant food is considered essential for purposes of control.

Using a rotation with two to several years of a grass-legume mixture, not over-heavily pastured, and abundant applications of manure and fertilizers, dark tobaccos can be topped at 16 to 20 instead of 10 to 12 leaves, and will probably give increased yields of high quality tobacco relatively free from blackfire injury. The evidence indicates that applications of well-rotted stable manure frequently prevent blackfire damage.

Darkis (F. R.), Vermillion (H. E.), & Gross (P. M.). **p-dichlorobenzene as a vapor fumigant: physical and chemical studies.**—*Industr. Engng Chem.*, xxxii, 7, pp. 946–949, 1 fig., 1 diag., 2 graphs, 1940.

Full details are given of experiments at Duke University, Durham, North Carolina, on the following phases of the para-dichlorobenzene treatment of blue mould of tobacco [*Peronospora tabacina*: *R.A.M.*, xix, p. 439 and next abstracts]: the effect of the five crystal sizes available on the market on the rate of evaporation, methods for the estimation of the fumigant in the atmosphere, and the determination of the vapour pressure of the crystalline solid in the temperature range of 10° to 50° C. The rate of loss of para-dichlorobenzene was found to be less for the larger crystal sizes of smaller exposed surface per unit weight and to decrease with a falling temperature. The smaller the crystal size, therefore, the slighter is the effect of a rise in temperature on the vaporization rate.

Pinckard (J. A.), McLean (Ruth), Darkis (F. R.), Gross (P. M.), & Wolf (F. A.). **Toxicity of paradichlorobenzene in relation to control of Tobacco downy mildew.**—*Phytopathology*, xxx, 6, pp. 485–495, 1 diag., 1 graph, 1940.

Much of the writers' experimental work (forming part of a co-opera-

tive study by the Virginia Agricultural Experiment Station and Duke University, North Carolina) on the factors affecting the toxicity of para-dichlorobenzene to tobacco downy mildew (*Peronospora tabacina*) has already been described [*R.A.M.*, xix, p. 306], but attention may here be drawn to the following point. Three or four consecutive treatments with the fumigant at the minimal effective concentration of 0·01 to 0·02 volume per cent., equivalent to saturation pressures from 0° to 7° C., are requisite for the eradication of the fungus from seed-beds of the susceptible Yellow Mammoth, White Stem Orinoco, and Jamaica varieties.

McLean (Ruth), Pinckard (J. A.), Darkis (F. R.), Wolf (F. A.), & Gross (P. M). **The use of paradichlorobenzene in seedbeds to control Tobacco downy mildew.**—*Phytopathology*, xxx, 6, pp. 495–506, 1 fig., 1940.

In addition to information already summarized from other sources [*R.A.M.*, xviii, p. 419 and preceding abstracts], the writers' further experiments in the use of para-dichlorobenzene for the eradication of *Peronospora tabacina* from tobacco seed-beds indicated that the correct amount of the fumigant is from 1½ to 3 lb. per treatment per 100 sq. yds., applications every three or even four nights, if the covers were adequately wetted, sufficing at the higher concentration. Temperatures exceeding 7° C. should be maintained in the seed-beds to promote effective vaporization. Para-dichlorobenzene vapours are approximately five times heavier than air and their maximum concentration occurred in the air near the crystals (0·0055 to 0·0092 per cent. compared with 0·0020 to 0·0035 per cent. at soil-level). The diffusion rate of a vapour being inversely proportional to its density, the permeation of the beds by para-dichlorobenzene may be expected to occupy a considerable time.

Bennett (C. W.). **Relation of food translocation to movement of virus of Tobacco mosaic.**—*J. agric. Res.*, lx, 6, pp. 361–390, 7 figs., 2 graphs, 1940.

Experiments were carried out at the Bureau of Plant Industry, United States Department of Agriculture, to ascertain whether the correlation already established between virus movement and food translocation in raspberry leaf curl [*R.A.M.*, vi, p. 675] and sugar beet curly top [ibid., xvi, p. 650] holds good for tobacco mosaic in Turkish tobacco and *Nicotiana glauca*.

In vegetative Turkish tobacco plants with their main stems and basal suckers in horizontal and vertical positions, respectively, the basipetal movement of the mosaic virus in the main stem was rapid, the entire length of the stem (more than 24 in.) being traversed and symptoms produced on the basal sucker in an average period of 6·8 days, and its acropetal progress slow (35·5 days before the appearance of symptoms in any part of the shoots); the latter period was reduced, however, to 20 and 12 days, respectively, by darkness and defoliation. On the other hand, in plants maturing seed on the main stem acropetal movement was rapid and basipetal motion slow. In *N. glauca* plants, with top and basal grafts of Turkish tobacco separated by 3 ft. of stem, the virus

moved from the top to the basal graft and produced symptoms in six to nine days. In seven out of ten plants no upward movement of the virus took place during periods ranging from 224 to 252 days, but, as in the case of Turkish tobacco, the process was accelerated to twelve days by defoliation. Turkish tobacco roots proved susceptible to infection, but lengthy periods (up to 67 days) were required for the virus to reach the tops and produce symptoms. Removal of the tops reduced the time of passage to a maximum of 48 days.

The tobacco mosaic virus traversed the rings, breaking phloem continuity in Turkish tobacco, but its passage was delayed by an average of eight days or more. In some *N. glauca* plants the corresponding rings were not passed in periods exceeding 250 days. The cucumber mosaic virus, however, was able to traverse the rings in 37 days. The fact that the tobacco mosaic virus does not ordinarily induce mottling in *N. glauca* suggests that the parenchymatous tissue in this species may not be conducive to movement and multiplication, which might in its turn account for the inability of the virus to pass through rings interrupting phloem continuity. Support is lent to this theory by the fact that such rings are uniformly traversed by the cucumber mosaic virus, which induces mottling on *N. glauca* and is therefore no doubt abundantly present in the parenchyma.

The evidence from these studies is considered to point to a correlation between virus movement and food transport in the case of tobacco mosaic, the factors involved probably not differing in essentials from those responsible for the passage of other plant viruses.

Matsumoto (T.) & Tateoka (R.). **Virus diseases of Tobacco in Formosa.** —*Trans. nat. Hist. Soc. Formosa*, xxx, 197–198, pp. 31–33, 1940.

The following virus diseases have been observed affecting tobacco in Formosa, Japan: common mosaic; mild mosaic type A (possibly identical with, or very closely related to, either of E. M. Johnson's two types of mild mosaic [*R.A.M.*, x, p. 60]); mild mosaic type B, a sap-transmissible, persistent condition characterized by faint foliar mottling, simulating veinbanding; yellow mosaic [ibid., xv, p. 533 *et passim*]; etch (probably identical with E. M. Johnson's disease of the same name); a composite disease due to a complex of common tobacco mosaic and a potato mosaic virus [ibid., xvii, p. 73]; leaf curl, transmissible by *Bemisia gossypiperda* [see above, p. 584] and most prevalent in the south near extensive cotton plantations; and other disturbances, including one attributed to a mixture of tobacco mosaic and a certain type of etch, further studies on which are pending.

Moore (E[nid] S.) & Anderssen (E. E.). **Notes on plant virus diseases in South Africa. I. The kromnek disease of Tobacco and Tomato. II. Die-back (mixed-virus streak) of Tomatoes.**—*Sci. Bull. Dep. Agric. S. Afr.* 183, 43 pp., 16 pl., 2 diags., 1939.

The results of further studies on the kromnek virus disease of tobacco and tomato in South Africa [*R.A.M.*, xiii, p. 129; xix, p. 196] seem to indicate that this disease is very similar to, and probably identical with, tomato spotted wilt [ibid., xix, p. 371]. The vector of the kromnek virus was identified as *Frankliniella schultzei*, one of the most widely dis-

tributed thrips in South Africa. To avoid the erratic results of previous transmission tests, insects used in the present study were reared from the egg stage on infected plants under controlled conditions. In tests the insects were allowed to feed for 24 hours on a confined area of the test plant, using a cage, which is a modification of that devised by Storey, and is fully described. A considerable proportion of successful transmissions was obtained on tomato, tobacco, and *Datura* plants by adult thrips; in two cases transmission was obtained with insects in the last larval stage, but in over 100 tests with young larvae up to six days old, only three transmissions were successful, indicating that an interval must elapse between the feeding of the larva on a diseased plant and the first development of its infectivity. In field studies it was observed that the incidence of kromnek in tobacco was very erratic, the percentage of fresh infection varying not only from season to season but also from month to month, and in fields in close proximity to each other. In seasons of severe outbreaks infection is general, while in other seasons it may be practically absent, even though *F. schultzei* is present in appreciable numbers. In no season have tomatoes been found to escape infection when grown in open situations. At all times the vector seems to be more attracted by the tomato than by the tobacco foliage when both are available. Strong field evidence, confirmed by successful, though few, transmissions, points to *Thrips tabaci*, which is widely distributed in South Africa, as an additional vector of the kromnek virus. The irregular incidence of the disease in the Pretoria district, which has been under observation since the serious outbreak of kromnek in commercial tomato plantings in 1933, can apparently be correlated with the relative size of a thrips population consisting mainly of *T. tabaci*, the vector mainly concerned with the spring outbreaks. Within the market garden area no extensive breeding of this species was observed on any host other than cabbage, cauliflower, and onion, but the probability of adult migration must not be overlooked. The results of spraying and dusting experiments for the control of the disease were negative. None of the ordinary commercial tomato varieties showed any marked difference in susceptibility; in tobacco the Amarelo and Burley varieties were found to suffer particularly severe damage from the disease, but others were also by no means resistant.

In the second of these two papers, by Miss Moore alone, the appearance is reported, in 1935, of an unfamiliar virus disease in the large tomato-growing areas of the eastern Transvaal. The infection is stated to have been widespread, causing great damage and loss in certain estates. In laboratory investigations in Pretoria the causative virus was separated by the use of filter plants into two constituents, No. 1 and No. 2, the latter having a higher thermal death point (89° to 90° as against 65° to 70° C.) and retaining its activity at a higher dilution (1 in 100,000 as against 1 in 500) than the former. The second constituent had all the properties of tobacco virus 1; this identity was confirmed in experiments in which tomato plants inoculated with a mixture of constituent No. 1 and tomato mosaic virus (tobacco virus 1) showed the characteristic symptoms of the die-back disease. Since it is known that streak symptoms in tomatoes are caused by a mixed infection with the viruses of ordinary tobacco mosaic and a potato virus of the X type,

some strains of the latter agreeing closely with constituent No. 1, it is concluded that the disease under observation is the same as that known in other countries as 'mixed virus streak' [ibid., xix, p. 372]. It is proposed to retain the name 'die-back' for local use, it being so characteristic a field symptom. The presence of potato virus X has not hitherto been experimentally proved in South Africa, but it was most probably imported on some of the many potato varieties which carry it without symptoms (including the Up-to-Date).

Jones (L. K.). **Fruit stripe of Tomato caused by a Tobacco type 1 virus.** —*Phytopathology*, xxx, 6, pp. 538–540, 2 figs., 1940.

Tomatoes in experimental field plots at Pullman, Washington, in 1936 and 1937 bore chlorotic to necrotic, raised, pale cream to ashen grey stripes, 1 to 2 mm. in width, extending from the stem to the blossom end and becoming broken, brownish, and sunken as the fruits enlarged. The foliage of affected plants showed a mild mosaic, without necrosis, which was also absent from the stems and petioles, in contradistinction to the symptoms of single-virus streak or of that caused by a combination of the tobacco mosaic and potato X viruses. On tobacco the virus produces only a faint mosaic on the young foliage, followed by profuse chlorotic spotting as the leaves mature. A combination of the potato X and fruit stripe viruses induced streak symptoms on tomatoes and on tobacco foliar necrosis, the manifestations in both cases resembling those due to joint infection by the tobacco mosaic and potato X viruses. The incubation period of the fruit stripe virus on tobacco and tomato ranges from 12 to 15 days; inactivation was effected by a ten-minute exposure at 90° but not at 80° C.; activity was maintained in a 1 : 1,000,000 dilution with water, and for a minimum period of 65 days *in vitro*. The general features of the virus under observation being identical with those of tobacco virus 1, it is accordingly regarded as a variant of tobacco mosaic.

Lancashire (E. R.) & Counter (B. F.). **Tomato production in 1940.**— *Canning Age*, xxi, 6, pp. 261–264, 2 figs., 1940.

Tomatoes are stated to suffer from early and late blights [*Alternaria solani*: *R.A.M.*, xix, pp. 7, 440, and *Phytophthora infestans*: ibid., xviii, p. 728] in all States of the American Union except Utah, the diseases being most severe when the general level of soil fertility is low, especially with a normal or excessive July rainfall. During each of the past three years virtual crop failures have been caused by the blights in certain sections of the largest tomato-producing States. Three applications of 4–2–50 Bordeaux mixture are recommended, beginning when the plants start to bush out and open up and continuing at ten-day intervals. The cost of each treatment, applying the spray at a pressure of 300 to 400 lb. per sq. in., should not exceed $3 per acre. Spraying operations are facilitated by a wider than normal spacing between the rows.

Miller (P. A.). **Notes on diseases of ornamental plants in southern California.**—*Plant Dis. Reptr*, xxiv, 11, pp. 219–222, 1940. [Mimeographed.]

In these notes it is stated that prolonged periods of wet weather

during the winters of the past few years probably account for the increased prevalence and severity of cypress canker (*Coryneum cardinale*) [*R.A.M.*, xviii, p. 562] recently noted in southern California. During the past year 14 *Cocos plumosa*, 2 *Phoenix canariensis*, 4 *P. reclinata*, 2 *Washingtonia filifera*, and 3 *Erythea edulis* palms affected by *Penicillium vermoeseni* [ibid., xviii, p. 451] were removed by the park department of Los Angeles. The symptoms on *E. edulis* and *P. reclinata* were typical of the disease as seen on *W. filifera*. Cultures of the fungus were obtained from affected tissues of *P. reclinata*. *Phytophthora citrophthora* from affected crowns of honey locust (*Gleditschia triacanthos*) produced typical brown rot in inoculated lemons. Crown rot lesions on loquat gave cultures of *P. cactorum* [ibid., xvii, p. 399], apparently the first record on this host in the United States. Owing, probably, to a mild, wet winter and a rainy spring, the same host was more widely and severely attacked by *Erwinia amylovora* [ibid., xviii, p. 506] than for many years, some trees suffering almost complete blossom blight, and much twig blight.

During 1939 coast live oak (*Quercus agrifolia*) in the coastal areas of southern California was affected by powdery mildew (*Sphaerotheca lanestris*). The perithecial stage was abundantly present on the leaves of some trees, but hot, dry weather towards the end of September apparently destroyed the conidia, while new growth developing after this hot period was unaffected. In July, 1939, carob trees (*Ceratonia siliqua*) in Riverside County showed typical symptoms of wilt, and pure cultures of a *Verticillium* were isolated from xylem tissues. This is stated to be the first record of the disease on the host in question. *Verticillium* wilt was also observed on a Brazilian pepper tree (*Schinus terebinthifolius*) at Los Angeles, and cultures of *Verticillium* were isolated from woody tissues of coral tree (*Erythrina caffra*) on another estate in the vicinity.

Christensen (C. M.). **Studies on the biology of Valsa sordida and Cytospora chrysosperma.**—*Phytopathology*, xxx, 6, pp. 459–475, 3 figs., 1940.

In the writer's studies at University Farm, St. Paul, Minnesota, the pycnidia and conidia of *Valsa sordida* developed on aspen in the field and in pure cultures on malt agar were indistinguishable from those of *Cytospora chrysosperma* [*R.A.M.*, x, p. 418; xix, p. 171] produced under comparable conditions, neither were there any consistent differences between the isolates of the two stages, though individual variations occurred within each group. Collections of *C. chrysosperma* from hosts other than poplar, i.e., Japanese walnut (*Juglans* sp.) and American elm (*Ulmus americana*), could not be separated from those on aspen and various other species of *Populus* (*P. candicans*, *P. alba* and its varieties *nivea* and *pyramidalis*, and *P. nigra*) on the basis of pycnidial structure, growth rate on agar, and general cultural characters.

C. chrysosperma is a common occupant of the bark of apparently healthy poplars, especially aspen and *P. alba*, and probably also of willow [*Salix*] and mountain ash [? *Pyrus americana*], but the degree of its parasitism on these hosts is regarded as open to doubt. The cankers associated with the presence of the fungus on ornamental poplars may

probably be combated by the development of varieties better adapted to their environment than those now commonly cultivated.

Ahrens (W. E.). **The practicability of detecting Dutch Elm disease by trunk sampling.**—*Phytopathology*, xxx, 6, pp. 521–527, 1 fig., 1940.

A leather punch with a bore ½ in. in diameter, driven into the trunk with a 1 lb. composition rubber mallet, was found to be a suitable implement for use in sampling tests at the Division of Forest Pathology, United States Department of Agriculture, on elms suspected of infection by *Ceratostomella ulmi* [*R.A.M.*, xviii, p. 717]. After a downward thrust to snap off the wood core, the punch was removed from the tree and the wood core ejected with a wooden plunger set in the handle of the mallet. The samples were taken at 6 in. intervals on the circumference of the tree at a convenient height, usually corresponding to the operator's shoulder line, and included wood from not less than two or more than five annual rings. After removal of the outer bark, the samples showing discoloration (with or without slicing) were placed in a glassine bag prior to culturing on potato dextrose agar. The application of wound dressing to the holes from which the samples were taken was made by means of a pump-type oil can.

During the dormant season of 1936–7 this method was applied to 6,031 elms passed as disease-free at the last inspection for foliar symptoms in the preceding summer. The 45 new infections discovered, increasing the total number for the period of the study from 114 to 159, constituted 28·3 per cent. of all those found in the plots by summer scouting and trunk sampling, the latter method being the less expensive of the two. Indications were obtained during the growing season that 80 to 92 per cent. of the infections expressed as foliar symptoms could be confirmed by trunk sampling about a fortnight later. The sampling technique used apparently inflicted no injury on the trees, the growth increment of which was not retarded, while none of the common fungi associated with decay in living trees was isolated from platings of wood adjoining healed or unhealed wounds.

The results of these experiments point to various uses of trunk sampling in relation to Dutch elm disease control, namely, to supplement summer inspections in areas shown by these to be unusually heavily infected; to determine the efficacy of summer scouting by sampling plots selected at random; and to replace summer examinations in wild or semi-wild areas in the vicinity of concentrations of valuable elms.

Campbell (W. A.) & Davidson (R. W.). **Ustulina vulgaris decay in Sugar Maple and other hardwoods.**—*J. For.*, xxxviii, 6, pp. 474–477, 1 fig., 1940.

The black, carbonaceous, crustose fructifications of *Ustulina vulgaris* [*R.A.M.*, xix, p. 49] are stated to be of common occurrence on large stumps and logs of red maple (*Acer rubrum*), sugar maple (*A. saccharum*), and beech in New England, New York, and Pennsylvania [ibid., xviii, p. 356], where the infected substratum is reduced to a mass of thin, dry, brittle, black sheets resistant to weathering and enabling the diseased wood to maintain its shape for many years. In the same region the fungus less frequently occurs as a saprophyte on birch and other trees.

Sugar maple sprouts are readily infected by *U. vulgaris* through the parent stump or the dead stubs of companion sprouts, profuse fructifications appearing both on the decorticated wood of the stubs and on the bark of the adjacent living sprouts. Flattened trunk cankers with the fruiting bodies of the fungus on the face are occasionally observed on red and sugar maples, on which they are apt to develop round infected companion stubs or from the outward penetration of the parasite through the sapwood with the consequent destruction of the cambium. In New England large trunk wounds on roadside maples are frequently infected by *U. vulgaris*, which is also sometimes formed in association with basal injuries, trees invaded in the latter manner often being killed by girdling.

U. vulgaris is fairly common on living beech, fruiting abundantly on flat, cankered areas at the base or on the trunk, as well as on the dead edges of basal injuries. It has also been isolated from butt rot in living paper birch (*Betula papyrifera*), ash (*Fraxinus americana*), and oak (*Quercus* sp.), while one case each of infection of living elm (*Ulmus americana*) and plane (*Platanus* sp.) are on record.

The average incidence of infection by *Ustulina vulgaris* on sugar maple sprouts in four areas of the Green Mountain National Forest, Vermont, was 12 per cent. compared with 68 per cent. for all the fungi concerned in the decay of the trees, the average upward extents of the rot being 57·4 and 44·9 in., respectively. The *Ustulina* decay is typical, consisting of a brittle, white column, having its maximum diameter at the base and tapering sharply upwards to a thin streak, with prominent black zones, arranged in irregular patterns through and around it.

In view of the relatively small number of potential saw timber trees likely to contract infection by *U. vulgaris*, specific control measures would not appear to be justified.

Jenkins (Anna E.) & Ray (W. W.). **A new host for Taphrina dearnessii and geographic distribution of Taphrina on North American Maples.**—*Mycologia*, xxxii, 3, pp. 408–414, 3 figs., 1 map, 1940.

A species of *Taphrina* found on mountain maple (*Acer spicetum*) causing a certain amount of wrinkling and blighting of the affected leaves near Ithaca, New York, in June, 1937, was determined as *T. dearnessii*, recently described on red maple (*A. rubrum*) from Canada and the United States [*R.A.M.*, xviii, p. 718]. In the *Taphrina* group on North American maples [cf. ibid., xix, p. 495] this is the second instance of one species infecting two different hosts. The present known distribution of *Taphrina* on maples in North America is shown on a map.

Mook (P. V.). **Three new locations for the Sycamore (Plane-tree) disease.** —*Plant Dis. Reptr*, xxiv, 10, pp. 205–206, 1940. [Mimeographed.]

The *Ceratostomella* disease [*R.A.M.*, xv, p. 329] is reported for the first time from Kentucky and Tennessee on *Platanus occidentalis*, and from a new locality in Delaware on *P. acerifolia*. In the last-named case a number of trees have already died.

Forbes (A. P. S.). **Some Tung Oil diseases in Nyasaland.**—*Nyasald Tea Ass. quart. J.*, iv, 4, pp. 6–10, 1940.

Notes are given on diseases of tung oil (*Aleurites* spp.) trees in Nyasa-

land. Leaf spot (*Glomerella cingulata*) is present on most estates. This disease takes the form of an irregular, yellowish green spot which, as it enlarges, becomes reddish-brown, with an indistinct yellowish margin. Old spots are greyish, with black dots in the centre, and in the final stages the affected tissue is ragged and broken. As a rule only the old leaves of healthy trees are affected. The disease appears, however, on young trees planted in an unsuitable environment, in which case it aggravates their condition; if weeds are allowed to grow near the trees, forming a humid atmosphere, the lower leaves are always attacked.

Die-back due to *Colletotrichum gloeosporioides* [by some regarded as the conidial stage of *G. cingulata*] is usually associated with twig or branch die-back due to mechanical injury, but unsatisfactory environmental conditions seem to predispose the trees to infection by this fungus, especially if the atmospheric humidity becomes too high. It is recommended that in cases of die-back the branch should be cut off at least 9 in. below the affected part nearest the trunk, and the cut surface tarred.

An unusual die-back of *A. fordii* seedlings has occurred on several estates. The plants are unthrifty, and show the presence of scale and lichen. The roots develop, but stem growth is retarded. Finally, the bark cracks at the collar, by which time leaves have begun to turn yellowish-brown and fall. The tree may or may not regenerate itself by the development of dormant buds below this region. The evidence indicates that the condition is non-parasitic; it has occurred only on seedlings planted in the dry season and is most prevalent in eroded areas. Affected seedlings should be cut back to the collar and the wound tarred.

The most important disease affecting tung trees locally is collar crack (*Armillaria mellea*), which is present in the virgin forest but causes little damage until the forest is removed, and the tung roots come into contact with those of decaying indigenous trees, when the tung trees are eventually killed. For purposes of control, trees and shrubs on all land to be opened up should be ring-barked at least 18 months before commencing planting operations [cf. *R.A.M.*, xvi, p. 564], and at intervals shoots developing below the ringed portion removed.

Ustulina zonata was twice found on dead tung trees under conditions which suggested that it was responsible for their death [ibid., xiii, p. 78].

A new disease was observed, in which the trees or seedlings passed through a process of degeneration sometimes resulting in the death of the terminal bud and of isolated patches of tissue on the stem. The leaves developed chlorosis and the veins remained green and prominent; the internodes were shortened and the leaves dwarfed and distorted. The shoot rapidly became thin and developed closely crowded nodes. Meantime, all the leaves formed before and after the condition appeared, except the youngest, dropped off, the death of the terminal bud being followed by a general die-back.

Wolf (F. A.). **A leafspot fungus on Nyssa.**—*Mycologia*, xxxii, 3, pp. 331–335, 1940.

Morphological studies of the fungus associated with leaf spot of *Nyssa sylvatica* and *N. biflora* in the south-eastern United States, and com-

monly identified as *Phyllosticta nyssae* Cooke, showed that it is a spermogonial stage with spermatia 3 to 3·5 by 1 to 1·5 μ, genetically connected with an ascigerous stage growing on decaying leaves and reaching maturity the following spring. Both spermogonia and perithecial primordia are found from August until October. By late March or early April the stromata have developed into mature perithecia 60 to 85 μ in diameter, globular except for a short ostiolar papilla projecting above the leaf surface. The cylindrical-clavate asci measure 25 to 30 by 6 to 7 μ, and the hyaline, uniseptate ascospores 8 to 10 by 3·5 to 4·5 μ, with the upper cell broader than the lower one. This ascigerous stage, originally described as *Sphaerella nyssaecola*, is renamed *Mycosphaerella nyssaecola* (Cooke) n. comb.

Waterman (Alma M.) & Aldrich (K. F.). **Rehmiellopsis needle blight of Balsam Fir in Maine.**—*Plant Dis. Reptr*, xxiv, 10, pp. 201–205, 1 map, 1940. [Mimeographed.]

The results of inspections made in 1936, 1938, and 1939 showed that an area covering roughly 15 localities (round the Moosehead Lake and to the south-west of it) in western Maine, was affected by the needle blight of balsam fir [*Abies balsamea*] caused by *Rehmiellopsis bohemica* [*R.A.M.*, xvi, p. 786]. Young trees in the dense growth about 150 to 200 ft. from the road were as severely infected as those growing exposed along the roads. The disease is gradually killing trees of all sizes, but particularly the seedlings.

Cartwright (K. St. G.). **Note on a heart rot of Oak trees caused by Polyporus frondosus Fr.**—*Forestry*, xiv, 1, pp. 38–41, 1 pl., 3 figs., 1940.

During a visit to the Forest of Dean in 1938 the author observed a white heart rot in the butt ends and stumps of two freshly felled oak trees. Cultures of decayed wood yielded *Polyporus frondosus*, which has not been previously recorded in England on living oak trees. The rot was of a type similar to that caused by *Stereum frustulosum* [*R.A.M.*, xix, p. 246], but the white pockets of rot were less pronounced, and in an advanced stage the decay was more stringy. In a less advanced stage the decayed area tended to be outlined by a water-soaked, reddish zone, and orange zone lines were present in some portions. In all probability the rot spreads upwards in the log, infection starting from the root.

In sections of oak wood gumming was present in certain areas, and the fine, hyaline hyphae, with simple, inconspicuous clamps, tended to be coloured by the gum. Penetration occurs through the walls of the wood, but more often through the pits. In an advanced stage of decay the lignified elements are attacked and the cellulose components hydrolysed.

On 2 or 5 per cent. malt agar mycelial growth is slow in the dark, and arrested or considerably retarded in the light. The mycelium is at first almost colourless; later, on 5 per cent. agar, a white, woolly to felty mat is produced, which becomes patched with colour, ranging from maize-yellow through light cinnamon-buff to antimony-yellow (Ridgway), especially in cultures grown in light. The mature mat is moderately smooth, tough like kid leather, and exudes yellow drops of liquid.

Fruiting is fairly frequent. The basidia, each with four sterigmata, measure up to 30 by 8 μ, and the basidiospores 5 to 6 by 3·5 to 4·5 μ; each spore has an obliquely placed apiculus. Secondary spores, which are both terminal and intercalary and very variable in size (20 by 15 μ up to 50 μ), are produced abundantly both on the aerial and the submerged mycelium. The mycelium gives a strong oxidase reaction when tested with gum and guaiacum mixture.

Offord (H. R.), Van Atta (G. R.), & Swanson (H. E.). **Chemical and mechanical methods of Ribes eradication in the White Pine areas of the Western States.**—*Tech. Bull. U.S. Dep. Agric.* 692, 50 pp., 11 pl., 1 map, 1 graph, 1940.

A full account is given of chemical and mechanical methods developed for the eradication of *Ribes* spp. in areas where hand-pulling and grubbing are ineffective and expensive, as part of the campaign against *Cronartium ribicola* which, in the western areas of the United States, threatens some five million acres of *Pinus monticola* and *P. lambertiana*.

For the eradication of *R. petiolare* atlacide (essentially a mixture of sodium chlorate and calcium chloride) is applied at the rate of 960 lb. per acre.

Investigations of the fire hazards of sodium chlorate under forest conditions showed that hygroscopic mixtures, such as sodium chlorate and calcium chloride, or mixtures containing a non-combustible filler, such as sodium bicarbonate or borax, are safer than sodium chlorate alone.

Ammonium thiocyanate and sodium chlorate were the most effective chemicals tested for killing *R. inerme*, but are recommended only for areas where destruction by mechanical means (the 'bulldozer' machine) [*R.A.M.*, xix, p. 176] is impracticable. The most economical method of eradicating this species by chemical products is to spray first with the dosage of maximum efficiency (2,160 lb. per acre ammonium thiocyanate or 2,346 lb. sodium chlorate), which gives about 81 per cent. bush kill, and a year later to treat the surviving bushes with a practical lethal dosage of 4,000 lb. or 4,600 lb., respectively.

A method involving decapitation and chemical treatment has been applied successfully to large or troublesome *Ribes* of the individual bush type. About 1 oz. of liquid or dry chemical is used for a crown some 2 in. in diameter, the dosage being increased proportionately for larger crowns. Diesel oil is used on *R. cereum* and *R. roezli*, a mixture of dry sodium chlorate and borax (1 : 5) on *R. viscosissimum*, and dry sodium thiocyanate or a saturated solution of ammonium thiocyanate on *R. bracteosum*. Preliminary chemical studies indicated that *R. erythrocarpum* can be inexpensively eradicated with atlacide spray (960 lb. per acre), while *R. bracteosum*, *R. irrigrum*, *R. lobbii*, *R. nevadense*, *R. sanguineum*, *R. triste*, and *R. watsonianum* require to be killed off by the decapitation technique.

Occasional areas of dense brush and *R. inerme* may be permanently suppressed by the bulldozer machine, a special type of which has been devised. With this machine all *Ribes* and bush are uprooted and pushed into long windrows. Hand-slashing of brush in conjunction with hand-pulling of *Ribes* has also been employed for clearing such areas,

where labour costs are low. In both cases the brush is burned and the cleared area planted to grass. The average costs per acre for the eradication of *R. inerme* by the bulldozer method, slashing, and chemical treatment are, respectively, $49, 58, and 96.

CHIDESTER (MAE S.). **A pink stain of wood caused by a species of Geotrichum.**—*Phytopathology*, xxx, 6, pp. 530–533, 1 pl., 1940.

A mould isolated from jasper-pink- or light jasper-red-stained sap- and heartwood of southern yellow pine [*Pinus* spp.] timber from New Orleans was characterized on malt extract agar at 25° C. by mealy colonies composed of clumps of ivory to baryta-yellow (hyaline at maturity), concatenate conidia, 2·7 to 4·1 by 2 to 3·6 μ, borne on irregularly and profusely branched conidiophores. A pinkish tinge is imparted to the medium, and the mycelium turns dark brown in some places and Tyrian blue in others. The organism was referred by W. W. Diehl to the genus *Geotrichum*, of which it is thought to be probably a new species. The same fungus has been isolated by the writer from red-stained cypress [? *Taxodium distichum*] heartwood, and by R. W. Davidson from the heartwood of a rotting oak log. The colour of the stain in the New Orleans pine wood was quite distinct from that of 'red heart' (the incipient stage of infection by *Fomes pini*), which was also present. A discoloration identical with that observed in pine was induced by inoculating the pink-staining fungus into sap- and heartwood sticks (first steamed for 30 minutes at atmospheric pressure) of silver fir (*Abies amabilis*), yellow birch (*Betula lutea*), black spruce (*Picea mariana*), loblolly pine (*Pinus taeda*), Douglas fir (*Pseudotsuga taxifolia*), red oak (*Quercus borealis*), southern cypress (*T. distichum*), and western hemlock (*Tsuga heterophylla*), those with a moisture content of 90 to 100 per cent. being more intensely and uniformly stained than those with a lower one (40 to 50).

LOHMAN (M. L.) & CASH (EDITH K.). **Atropellis species from Pine cankers in the United States.**—*J. Wash. Acad. Sci.*, xxx, 6, pp. 255–262, 2 figs., 1940.

The genus *Atropellis* is revised to include, besides *A. pinicola*, the agent of branch or stem cankers of several kinds of pine in the Pacific Northwest and California [*R.A.M.*, xv, p. 117], two new species, *A. tingens* and *A. arizonica* [with Latin diagnoses], the former observed on the twigs, branches, and small stems of *Pinus banksiana*, *P. caribaea*, *P. clausa*, *P. densiflora*, *P. echinata*, *P. nigra*, *P. pinaster*, *P. pungens*, *P. resinosa*, *P. rigida* and its var. *serotina*, *P. strobus* (occasional, in Virginia only), *P. taeda*, and *P. virginiana* in the eastern half of the United States, and the latter on *P. ponderosa* stems in Arizona. *Cenangium piniphilum* [loc. cit.] on *P. banksiana*, *P. contorta*, *P. jeffreyi*, *P. ponderosa*, *P. taeda*, *P. albicaulis*, *P. monticola*, and *P. virginiana* is renamed *A. piniphila* (Weir) comb. nov.

The *A.* cankers of the United States differ from those associated with the allied genus *Crumenula* in Europe [ibid., xvi, p. 136] in their furfuraceous exciples, stellate or irregularly lacerate apertures, and blue-black epithecia, as well as in the type of canker produced and the

characteristic discoloration of the host tissue by the mycelium (a localized dark stain in the American material examined).

Crowell (I. H.). **Heart bluestain of White Spruce and Balsam Fir.**—*Pulp Pap.* (*Mag.*) *Can.*, xli, 7, pp. 451–452, 5 figs., 1940.

Blue stain of conifer heartwood (as distinct from the sapwood) is stated to be almost unknown, but the author recently received from Shelter Bay, Quebec, specimens of white spruce (*Picea canadensis*) and balsam fir (*Abies balsamea*) in which practically the entire heartwood was penetrated by a roughly circular, deep blue stain, leaving the sapwood free. Many short, blackish lines extended continuously from the radial to the tangential surface and were identified as fungal hyphae developing in small plates of tissue in a transverse or horizontal plane. The dark olivaceous, septate, cottony hyphae slowly emerging from the stained areas of wood blocks in a moist chamber remained completely sterile for five weeks, thereby precluding any possibility of identification for the time being. No rotting or disintegration of the discoloured wood could be detected. The only other report of blue stain of heartwood known to the author refers to a single slow-growing spruce in Norway, in which the bluish-grey discoloration was confined to a very small area just above soil-level, where it tapered to a fine point

Birkinshaw (J. H.), Findlay (W. P. K.), & Webb (R. A.). **Biochemistry of the wood-rotting fungi. 2. A study of the acids produced by Coniophora cerebella.**—*Bio-chem. J.*, xxxiv, 6, pp. 906–916, 1940.

The amount of acid produced by *Coniophora cerebella* [*C. puteana*], both in malt solution and on Scots pine [*Pinus sylvestris*] sapwood, being substantially larger than that derived from any of the other wood-destroying fungi tested, the organism in question was selected for closer investigation (within the framework of the series of studies on fungal biochemistry now in progress [*R.A.M.*, xix, p. 448]).

The acidic products formed by *C. puteana* (Idaweiche strain) [ibid., xviii, p. 829] after incubation periods of two, four, and six months were identified as formic, acetic, traces of oxalic, and relatively large quantities, equivalent to about one-third of the total titratable acidity after the two longer incubation periods, of citric acid, isolated as the methyl ester. Other acids of higher molecular weight, believed from the results of qualitative tests to be hexuronic. were also present. Volatile acids, including formic, were also found to occur in sound wood, in amounts comparable with those recorded for the decayed samples, and cannot, therefore, be regarded as metabolic products of the fungus. Citric acid, on the other hand, occupies an entirely different position, being a true metabolic product of the growth of *C. puteana* on pine wood.

Riley (C. G.). **Deterioration in piled pulpwood.**—*Pulp Pap.* (*Mag.*) *Can.*, xli, 7, p. 450, 1940.

In an experiment started in 1932 in the Gatineau drainage basin of Quebec by the Dominion Forest Pathological Service with the co-operation of the Canadian International Paper Company, the rate of decay in piled pulpwood was studied in relation to (1) species of wood, (2) peeling, (3) conditions of site, and (4) season of cutting. Black and

white spruce [*Picea mariana* and *P. glauca*], balsam [*Abies balsamea*], and Jack pine [*Pinus banksiana*] of commercial sizes were cut into 4-ft. lengths and piled separately on skids, one half of each pile being peeled and the other left with the bark on. Four sets of duplicate piles, one in a dry, open field, and the other in swampy ground, were established in early September, mid-October, early December, and June. Annual inspections showed that in all the piles the peeled considerably outlasted the unpeeled wood, but decortication was accompanied in the June and September piles in the open site by the unpleasant feature of excessive cracking, due to rapid drying of the wood. Peeling acted as a strong deterrent of blue and red stain in black spruce, but failed to prevent these defects in *P. banksiana*, which decayed rapidly under all circumstances. All the other woods remained in better condition on the dry than on the damp site.

Starker (T. J.). **Preservative treatments of fence posts: 1938 progress report on the post farm.**—*Bull. Ser. Ore. Engng Exp. Sta.* 9, 21 pp., 3 figs., 1 diag., 1 graph, 1938. [Received May, 1940.]

The 'post farm', established in 1927 at the School of Forestry, Oregon State College, 'is a plot of ground of uniform character selected to determine the lasting qualities of different species of wood and different preservative treatments when in contact with the soil'. Annual examinations of the treated posts have been made since 1932, their condition being ascertained by the application of a 50 lb. pull 2 ft. from the ground with a spring balance attached to a loop of wire round the post. The following are some of the data from the 47 series included in the experiments. None of the 25 second-growth Douglas fir [*Pseudotsuga taxifolia*] posts (25 years old) treated with one tablespoon of mercuric chloride and common salt in one ¾ in. hole bored at ground line had failed at the date of the last inspection (1938), whereas the controls of the same age and origin were all rotted, their average life having been only 84 months. Entirely satisfactory results with Douglas fir were also given by the same treatment with the addition of arsenic introduced through two or three holes; Anaconda Copper Company treater dust and paste, the latter applied at 2 or 4 lb. per post; a mixture of 70 per cent. creosote and 30 per cent. fuel oil, 1½ to 16 lb. absorption (posts set up in 1929), and Z[inc] M[eta] A[rsenite: *R.A.M.*, xv, p. 486], average retention 0·207 lb. per cu. ft. The tops of white cedar [?*Thuja occidentalis*] poles given an open-tank treatment in 1928 by the Carbolineum Wood Preserving Company, Springfield, Oregon, involving four hours' immersion in hot oil (225° to 230° F.), followed by a bath in oil at not less than 150°, were still sound at the last inspection, as were likewise 25 western hemlock [*Tsuga heterophylla*] vacuum-pressure-treated with thanalith, securing 0·302 lb. retention per cu. ft.

Data from five series of posts removed *en bloc* clearly demonstrated the unsuitability for permanent fence lines in an untreated state of cottonwood [*Populus* spp.], alder, madrone [*Arbutus menziesii*], and big-leaf maple [*Acer macrophyllum*], which failed after 55, 69, 69·6, and 76 months, respectively, besides Douglas fir, referred to above.

Appendices A, B, and C describe, respectively, the wood requirements for farm fences, the above-mentioned mercuric chloride-arsenic-

salt treatment, and the open-tank process, usually applied with coal tar creosote.

MÖRATH (E.). **Practical results in the preservation of wooden telegraph and transmission poles.**—35 pp., 8 figs., 1 graph, International Advisory Office on Wood Preservation, Oranjestraat 9, The Hague, Holland, 1939.

In this interesting booklet are given data regarding the position of wood preservation in 17 European countries compiled on the basis of replies to a questionnaire circulated to the telegraph and telephone authorities and those of large power stations by the International Advisory Office on Wood Preservation. Some of the data have already been summarized from another source [*R.A.M.*, xix, p. 447], but it may be mentioned that the principal North American telegraph companies estimate the average life span of creosoted poles at 50 years, doubtless owing to the heavier absorption generally prescribed (125 or even up to 190 kg. per cu. m. = 7·7 to 11·8 lb. per cu. ft.) as compared with normal European practice. It is apparent that up to the present creosote is much the most reliable preservative available, and hence its consumption exceeds that of all the others together [ibid., xvii, p. 426; xviii, p. 656 *et passim*].

STEWART (D.). **The use of treated wooden poles in India for electric distribution and service.**—*Indian For.*, lxvi, 3, pp. 146–154, 1940.

Summing up the position in India with regard to the preservation of wooden poles in relation to Mörath's international survey of the methods adopted in European countries [see preceding abstract], the writer draws attention to the extremely exacting conditions prevailing in India both in respect of climate and abundance of wood-destroying fungi. Data based on experience with a total of 17,000 poles showed that those treated with coal tar creosote and fuel oil (50:50) are still in good condition to date after 3 to 8 years' service but that unsatisfactory results were obtained with a mixture containing wood tar creosote and coal tar creosote and with a new water-soluble preservative. It is evident, therefore, that the difficulties (mainly of cost and convenience) connected with the application of the invaluable standard creosote treatment will have to be overcome in order to avoid further waste of material. For Indian conditions a minimum absorption of 10 lb. creosote plus 5 lb. fuel oil will no doubt be essential.

THOMAS (A. V.). **Experiments with impregnated pit props.**—*Malay. Forester*, ix, 2, pp. 74–77, 1940.

Notes are given on three experiments in the preservation of pit props (of species not botanically identified) carried out in the mines of Malayan Collieries Ltd. A number of the props treated in 1930 by the Lowry process [*R.A.M.*, xvii, p. 2] with 25 per cent. creosote and 75 per cent. Diesel fuel at a pressure of 120 lb. per sq. in., built up in 30 minutes and held for 25, absorption per cu. ft. ranging from 1·7 to 9·9 lb., were still in good condition after 2½ years, whereas most of the untreated had to be replaced twice during the first 18 months of the experimental period. All the material impregnated in 1933 with equal parts of creosote and

Diesel fuel, each end of the butt being immersed in the preservative for four hours at 200° F. and cooled off for 16½ hours, absorption 2 to 7·5 lb. per cu. ft., was still sound after 67 months, compared with an average life for the untreated of 45. In another test in 1933 with the same proportions of creosote and fuel, all were in good condition after 2 years and 4 months [cf. preceding and next abstracts].

HARDY (E.). **Pit-prop fungi.**—*Colliery Engng*, xvii, 195, pp. 116–117, 1 fig., 1940.

The most common agents of pit-prop decay in British mines are stated to be *Merulius lacrymans*, *Poria vaporaria* [*P. vaillantii*], and *Coniophora cerebella* [*C. puteana*: *R.A.M.*, xviii, p. 361 *et passim*], simple descriptions of which are given as aids to identification. *Lenzites sepiaria* is also apt to be troublesome, especially on pine wood, but unlike *M. lacrymans*, it cannot attack hardwoods. Under excessively warm and humid conditions *Fomes annosus* is the chief cause of decay in pine and other soft woods, while *Polystictus versicolor* is found on oak and other hardwoods. Waterlogged props of any sort are subject to infection by *Armillaria mellea*, the advance of which may be so rapid as to necessitate renewal of the wood within six months. *M. lacrymans* may be controlled with creosote (also effective against *A. mellea*), tar, boric acid, or the dinitrocresates of potassium or sodium.

PABLO. **Träimpregnering med arseniksalter.** [Timber impregnation with arsenic salts.]—*Skogen*, xxvii, 5, pp. 101–104, 6 figs., 1 diag., 1940.

A description is given of the technical aspects of the process of timber preservation by means of impregnation with a solution of arsenic acid, disodium hydrogen arsenate, sodium bichromate, and zinc sulphate, which is successfully employed at the Boliden Mining Company's works in Sweden [*R.A.M.*, xvi, p. 649; cf. also xviii, p. 220]. The substances are combined in certain proportions, and a chemical reaction takes place in the treated wood resulting in the formation of zinc hydrogen arsenate and chromium arsenate, which are precipitated and become insolubly fixed in the wood. These two salts are the active agents in protection and it is essential for the efficacy of the treatment that the arsenic content should not fall below the equivalent of 0·1 per cent. arsenic pentoxide. The wood is subjected to 12 hours' low-pressure vaporization prior to immersion for 24 hours in a cold bath of the chemical disinfectant, of which 250 kg. is absorbed by each cu. m. of pine wood, allowing for a penetration of 1 per cent. arsenic pentoxide into the sapwood at the normal strength of the mixture.

RENNERFELT (E.). **Investigations of damages caused by fungi in wet mechanical wood-pulp.**—*World's Pap. Tr. Rev.*, Tech. Suppl., cxii, 24, pp. 169–175, 1939; cxiii, 2, pp. 1–3, 8 figs., 1940.

Some of the information presented in this useful survey of investigations by the writer and others on fungal damage to wood pulp [see next abstract] in Sweden has been noticed from other sources [*R.A.M.*, xix, p. 250 *et passim*], but the following points may be mentioned. Of the four principal sources of infection, viz., the wood, the fresh water, the mill air, and the white water or circulating system of the mill, the

second is of most importance in mills constructed on the old-fashioned open system, which use about 10,000 l. fresh water per minute. An examination of fresh pulp revealed 10 per cent. infection originating in the fresh water as compared with under 1 per cent. in material produced in mills with closed systems using 1,000 l. or less per minute. Generally speaking, mill air is not a major contributory factor to the fungal infection of pulp, being responsible, according to the writer's calculations, for not more than 0·1 per cent. The blueing fungi (*Phialophora fastigiata*, *Pullularia pullulans*, and under certain conditions *Ceratostomella piceae*) and moulds (*Aspergillus*, *Oidiodendron*, *Penicillium*, and *Trichoderma* spp.) on the spruce wood are largely killed off by the high temperature developing during the grinding process, so that newly ground pulp is practically sterile. In open-system mills, where the temperature of the white water is only slightly higher than that of the fresh water (25° C. in summer and 5° to 10° in winter), the average incidence of infection, chiefly by *Geotrichum candidum* and other Torulopsideae, averages only 100 to 300 spores per c.c., whereas in closed systems the numbers are much larger (300 to 1,200) at relatively low temperatures (not exceeding 40°) but fall practically to zero at 55° to 60°: here again the Torulopsideae predominate, being 5 to 16 times more frequent than the other organisms under discussion. The pulp is infected in such a way that 10 to 40 per cent. of the spores in the white water are filtered away at the same time as the fibres on the kamyr machine. A large number of the spores in the white water do not find their way into the pulp, but return to the system.

Conditions in the pulp are more favourable to the development of moulds, the blueing fungi, and [unspecified] agents of 'brown' and 'dry' rot than to the growth of the Torulopsideae, and during storage the number of spores belonging to organisms of one or other of these groups may increase to 1,000,000 per gm.

Of the various chemicals so far tested for the control of fungal infection in paper mills, borax and sodium fluoride are effective against decay but tend to stimulate the growth of moulds, especially *Penicillium* spp., a similar activating effect on which is produced by sulphurous acid. In addition to disinfectants previously reported on, pulpasan has given very promising results in a couple of mills. Like lignasan, this preparation contains 6 per cent. ethyl mercury chloride and is used at a rate of 200 gm. per ton wet pulp. Certain species of *Penicillium* are very resistant even to this powerful fungicide, but the difference between treated and untreated material is striking, and no deleterious action is exerted by the infinitesimal amount of mercury remaining in the pulp after washing.

Nason (H. K.), Shumard (R. S.), & Fleming (J. D.). **Microbiology of pulp and white water systems.**—*Paper Tr. J.*, Tappi Sect., cx, 13, pp. 30–36, 10 figs., 1940.

Most of the common wood-destroying fungi are stated by Kress *et al.* [*R.A.M.*, iv, p. 645] to be involved in the causation of damage to mechanical pulp in American paper mills. Most of the staining fungi reported from Scandinavia [see preceding abstract] have also been detected on damaged pulp in the United States or Canada. Some of these,

mostly belonging to the group of common moulds, e.g., *Penicillium* spp. and *Aspergillus niger*, produce stains that wash out in the beater and do not affect the finished sheet; while a species of *Haplographium* forms a heavy, black, sooty growth on the surface of the lap which is completely eliminated in the beaters. Other staining organisms are more troublesome, producing hard, brown or black specks extending through the pulp lap and persisting right through the beating process to the finished sheet. To this class belongs, for instance, *Cadophora* [*Phialophora*] *richardsiae* [ibid., xvii, p. 178; xviii, p. 362], isolated from specked Wisconsin groundwood pulp.

One of the most suitable and effective fungicides for the cleansing of paper mill systems is sodium pentachlorophenate, the incorporation of which with the pulp (sprayed on the lap during formation on the wet machine) at the rate of 2 to 4 lb. per ton will prevent rotting, discoloration, and specking during damp storage. The same compound may be used with advantage for the mildew-proofing of paper and boxboard at concentrations of 0·06 to 0·5 per cent. of the weight of the moisture-free fibre; for the preservation of felts against biological rotting (in a weak solution); and for the prevention of souring or putrefaction of stocks in process held over during the shut-down period (5 lb. per ton).

Beckwith (T. D.), Swanson (W. H.), & Iiams (T. M.). **Deterioration of paper : the cause and effect of foxing.**—*Publ. Univ. Calif., biol. Sci.* i, 13, pp. 299–356, 9 pl., 1940.

The form of paper deterioration known as 'foxing', characterized by the production of rusty-red areas over the surface, has been found not to be primarily due to chromogenesis by fungi, although the pigments secreted by the latter may contribute to the development of the defect and both fungi and 'foxing' are most prevalent on substrata with an acid reaction. The iron commonly occurring in the ferric state in paper also favours mould growth, which is further stimulated by certain sizings and fillers, such as starch, dextrin, and gelatine. Little or no fungal growth is made in an atmosphere of less than 75 per cent. relative humidity. The presence in paper of living or dead hyphae, as well as of some of the degradation products of cellulose, may be histologically demonstrated by the application of certain staining methods involving the use of (*a*) safranin and aniline blue, (*b*) Pianese IIIb, (*c*) Victoria blue, and (*d*) iodine and potassium iodide. Of the species of *Alternaria*, *Monilia* [*? Candida*], *Aspergillus*, *Penicillium*, *Mucor*, *Stemphylium*, *Hormodendrum*, *Fusarium*, *Chaetomium* [cf. *R.A.M.*, xviii, p. 696], and *Byssochlamys* isolated from old materials in the Huntington Library of the University of California (*Aspergillus* and *Penicillium* predominating), pigmentation was produced in cellulose broth at room temperature only by the green and blue species of *P.* [*P. digitatum* and *P. italicum*, respectively], a grey *P.*, and a species of *H.*, the colours associated with which were dark greenish-yellow to light brown, yellow, brownish-yellow, and dark green, respectively. Attempts to combat fungal deterioration by chemical treatments [cf. ibid., xix, p. 317] gave somewhat disappointing results, since the compounds toxic to the pathogens, e.g., 1 per cent. mercuric chloride, 1·5 per cent. mercuric salicylate, 1 per cent. tribrombetanaphthol, 2 per cent. orthocresol, and

1 per cent. mercuric benzoate, likewise tended to induce undesirable changes in the paper.

Okamoto (H.). **On the relation of root pests to black rot of Sweet Potato root-tuber in the field.**—*Ann. phytopath. Soc. Japan*, x, 1, pp. 27–35, 2 figs., 1940. [Japanese, with English summary.]

The black rot fungus (*Endoconidiophora* [*Ceratostomella*] *fimbriata*) was observed to enter sweet potato tubers [*R.A.M.*, xvii, p. 506] in the field mostly through cavities made by the feeding of various insect pests, e.g., *Cylas formicarius* and *Colasposoma oberthüri* in the Okinawa-honto district of Japan. The longer the time elapsing after feeding, the more difficult it is for the pathogen to gain ingress through these channels. The extermination of the pests in question is therefore an important means of combating *Ceratostomella fimbriata*.

Crosier (W.) & Patrick (S.). **Influence of chemical and thermal treatments on infection of cruciferous seedlings by Alternaria spp. and Rhizopus nigricans.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1939*, pp. 116–120, 2 figs., 1940.

In seed disinfectant tests with cruciferous hosts carried out at Geneva, New York, in 1938, a soak of 25 minutes in hot water (50° C.) or a dip in a 0·2 per cent. suspension of new ceresan increased the percentage of germinating seeds of Copenhagen cabbage from 64 to 76 and 80, respectively, with only 3 and 5 per cent., respectively, of the sprouts being infected by the pod spot organisms, *Alternaria brassicae* and *A. circinans* [*R.A.M.*, xviii, p. 495], and the common black mould *Rhizopus nigricans*, as compared with 63 per cent. in the untreated control. In tests with other disinfectants, applied as dips and dusts to cabbage, radish, and broccoli seeds, mercurial materials compared favourably with hot-water treatments, while oxides of copper and zinc were noticeably less effective. It is concluded that when control of fungi alone is desired, the mercurial dusts possess advantages over the other materials, provided the seeds were well covered with dust and all the non-adhering excess is removed. Consistently satisfactory results were obtained with barbak C. [ibid., xviii, p. 787], an organic mercurial compound, which yielded on the average 8·2 per cent. more normal sprouts than any of the other mercurial dusts.

Porter (R. H.) & Rice (W. N.). **Laboratory and field germination of treated and untreated Beet seed.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1939*, pp. 127–130, 1940.

In laboratory tests at Ames, Iowa, in 1936, with beet seed-clusters which harboured infection with *Phoma betae* [*R.A.M.*, xix, pp. 132, 319], seed treated with 1 per cent. ethylmercury phosphate prior to planting in autoclaved soil yielded an average of 266·7 normal seedlings and 7·3 diseased ones from 100 seed-balls compared with 157 and 24·7, respectively for untreated seed. When planted in blotters, sand, or soil untreated seed produced approximately the same number of healthy seedlings, and the data obtained with treated seed seem to indicate that *P. betae* prevented the germination of many untreated seed-clusters in blotters and the emergence of many in both sand and soil.

In comparative tests carried out during 1938–9 treatment of garden beet, mangel, and sugar beet seed with 1 or 5 per cent. ethylmercury phosphate or semesan had a beneficial effect on the emergence of seedlings in the field, but made little difference in the laboratory. The mean figures for all three crops in the field showed an increase of nearly 70 per cent. in the number of seedlings raised from seed treated with 5 per cent. ethylmercury phosphate over the untreated control. The results indicate that garden beet and mangel respond to treatment in a similar manner to sugar beet and that infection by *P. betae* of *Beta* spp. may be largely controlled by seed disinfection.

YOUNG (H. C.). **Soil conditions affecting Sugar Beets.**—*Sug. Beet J.*, v, 7, pp. 127–129, 137–138, 1940. [Abs. in *Facts ab. Sug.*, xxxv, 7, p. 36, 1940.]

In a soil temperature experiment [in the United States] involving the use of greenhouse tanks regulated to six different temperatures between 54° and 89° F. and kept very or slightly dry and very or slightly wet, the lowest incidence of black root [*R.A.M.*, xvii, p. 506] and the best beets developed at 54° and 61° in the slightly dry and slightly wet soils. Seedling diseases in general are much less prevalent in light, well-aerated soils than in heavy ones: the incorporation of peat and muck in a medium-heavy soil led to a substantial decrease of damping-off [*Pythium de Baryanum*, *Corticium solani*, and other organisms], good control of which has also been obtained by seed treatment with ceresan [ibid., xix, p. 131] or red copper oxide.

WATSON (M[ARION] A.). **Studies on the transmission of Sugar-beet yellows virus by the aphis, Myzus persicae (Sulz.).**—*Proc. roy. Soc.*, Ser. B., cxxviii, 853, pp. 535–552, 1940.

In studies on the vector—virus relationship of the sugar-beet yellows virus [*R.A.M.*, xviii, p. 429] conducted at Rothamsted, the author used the virus propagated from material received from Prof. Quanjer, Wageningen, the symptoms produced by which were similar to mild strains of the virus obtained from leaves collected in four counties in England, whereas strains from Rothamsted and Hornsea (Yorks) were more virulent, causing vein-clearing of medium-aged leaves and local symptoms on older ones. The experiments were designed to test the efficiency of the vector, *Myzus persicae*, in transmitting the virus from infected to healthy plants after varying times of feeding. The infectivity of the vector was found to increase greatly with increasing feeding time on the infected and on the healthy plant, infections after feedings of 2 minutes, 1 hour, and 18 hours on infected plants being 0, 11, and 69 per cent., respectively, and after feedings of 20, 30, 40, 90, and 180 minutes on healthy plants following constant infection feeding of 18 hours, 17, 23, 31, 58, and 61 per cent., respectively. When fed on two consecutive healthy plants the amount of infection obtained on the second decreased with increasing time of feeding on the first healthy plant. Infections were produced in a succession of healthy plants for one, two, and three days. There was no indication of a definite 'incubation period' of the virus in the vector, below which no infectivity could

be obtained. The virus of sugar beet yellows is thus different from the non-persistent viruses [ibid., xix, p. 562] which cease to be infective within a few hours of removal of the vector from the infected plant. A comparison with the sugar beet curly top virus [ibid., xix, p. 250] seems to indicate that with neither virus is there a period after feeding on infected plants during which the vectors are unable to transmit the virus but merely a period of increasing infectivity towards a maximum at which all insects capable of transmitting it will do so. It is suggested that the behaviour of the virus in response to varying feeding times on both infected and healthy plants can be explained on a purely quantitative basis by assuming that the amount of virus taken up by the vector increases with the time of feeding on the infected plant. It is possible that effective transmission of the virus is delayed, for it may be that time is required for the virus to circulate through the body of the vector, and this would account for the increased infectivity of vectors with prolonged feeding times on the healthy plants.

ZAUMEYER (W. J.). **Three previously undescribed mosaic diseases of Pea.** —*J. agric. Res.*, lx, 7, pp. 433–452, 4 figs., 1940.

A comprehensive, tabulated account is given of the writer's studies on three hitherto undescribed mosaic diseases of the pea, herein designated pea mosaic virus 4, pea mosaic virus 5 (pea stunt mosaic), and alsike clover mosaic virus 2, as well as on alsike clover mosaic virus 1, previously reported by Wade and Zaumeyer [*R.A.M.*, xviii, p. 6]. (In F. Weiss's classification of the legume viruses [ibid., xix, p. 230], pea mosaic virus 4 becomes *Pisum* virus 3 A, pea mosaic virus 5 *Pisum* virus 5, alsike clover mosaic virus 1 *Trifolium* virus 3, and alsike clover mosaic virus 2 *Trifolium* virus 3 A.) The viruses were differentiated on the basis of (1) the symptoms they produce on peas and beans, (2) the susceptibility and resistance of several varieties of pea, bean [*Phaseolus vulgaris*], other legumes, and other hosts, and (3) physical characters.

Pea mosaic virus 4, isolated from diseased plants in north-eastern Colorado, induced relatively mild symptoms on the test varieties, Dwarf Telephone, Telephone, and Green Giant, in greenhouse inoculations, the typical foliar mottling somewhat resembling that described by Stubbs for pea viruses 2 B and 2 C [ibid., xvi, p. 583]. The dark green tissue was mostly situated next to the veinlets, while small yellowish streaks or islands appeared later.

Pea mosaic virus 5 produced severe stunting of the two Telephones, the affected plants reaching only about a quarter of their natural size, but mottling was faint. The internodes were shortened, and an intense purple discoloration of the stem was followed by contraction of the tissue. The infected leaves were killed about a week after inoculation and necrosis ensued, starting at the base of the lamina and later extending over the entire leaflet. On Dwarf Telephone the growing point was often rosetted, the internodes were shortened, and the leaves were very compact, curled, and abnormally small. Both on this variety and Telephone the terminal growth frequently became flaccid and died, and later the whole plant succumbed. Green Giant reacted quite differently to pea mosaic virus 5, showing little stunting or foliar malformation but decided mottling.

All three test varieties responded similarly to inoculation with alsike clover mosaic virus 1, the typical foliar mottling due to which was reminiscent of that caused by pea virus 3 [ibid., xvii, p. 91], though slightly less intense, and also of Stubbs's 2 B.

The symptoms induced by alsike clover mosaic virus 2 were more severe than any of the others reported, stunting being particularly noticeable on Dwarf Telephone. There was no mottling, but the inoculated leaves usually died. Above the region comprising the first, and sometimes the second, node from the site of inoculation, the leaves were yellowish-green, crinkled, and only a quarter to one-eighth of the normal size. Typical symptoms, followed by the development of numerous small, brown, necrotic spots, appeared on the leaves arising from buds at the axils of the inoculated leaves, as well as on the offshoots emerging from below the site of inoculation. The infected leaflets and stipules presented a water-soaked, semi-transparent aspect. The diseased leaves finally died and were shed, leaving the bare stem and the malformed growing tip, which sometimes died later, a few green, apparently normal leaves remaining above the point of inoculation. The stems and petioles became very brittle, and such pods as were produced were malformed, badly spotted and pitted, and failed to reach maturity.

Of the 12 pea varieties inoculated with the four viruses, all were susceptible except Horal, Little Marvel, Perfection, Surprise, and Wisconsin Early Sweet.

Of the seven bean varieties inoculated with the four viruses, Stringless Green Refugee was susceptible to all, Great Northern U.I. No. 1 to pea mosaic virus 5 only; Corbett Refugee and Wisconsin Refugee were resistant to pea mosaic virus 4 and U.S. No. 5 Refugee to pea mosaic virus 5. Considerable differences were observed in the symptoms produced on the several varieties.

Pea mosaic virus 4 was the only one of the four viruses to infect red clover, other susceptible hosts of the viruses being confined to the Leguminosae. Hosts susceptible to one virus were generally susceptible to all.

The thermal inactivation points of pea mosaic viruses 4 and 5 and alsike clover mosaic viruses 1 and 2 were found to lie between 62° and 65° C., 60° to 62°, 60° to 62°, and 54° to 58°, respectively. Pea mosaic viruses 4 and 5 and alsike clover mosaic virus 2 were still capable of causing infection at a dilution of 1 to 8,000, at which point alsike clover mosaic virus 1 had lost its potency, though it was still infectious at 1 to 6,000. After ageing *in vitro* for one to two days pea mosaic virus 4 and the two alsike clover mosaics were no longer infectious, while pea mosiac virus 5 was deprived of its virulence in less than one day.

A table is given showing certain important differential characters of most of the viruses affecting pea.

Crosier (W. F.). **Sub-committee on seed sanitation.**—*Proc. Ass. Off. Seed Anal. N. Amer., 1939*, p. 77, 1940.

This report gives the results of chemical treatment of pea seed of the varieties Chief, Thomas Laxton, and Winner against *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xiii, p. 495] and *Sclerotinia sclerotiorum* in seed germination tests. It was shown that the presence of *C. solani* in

or on 5 per cent. of peas is sufficient to interfere with the appraisal of the seed stock. Either cuprous oxide or ceresan applied only to the inocula of mummified peas increased the percentages of healthy sprouts. When either chemical was applied to both seeds and mummified peas, as would occur in commercial practice, the apparent germination closely approximated that of the uninoculated control. The presence of *S. sclerotiorum*, which is stated to be an infrequent associate of pea seed, in only one pea may destroy one-half of the seedlings in a 100-seed test. In experiments with Thomas Laxton and Winner varieties untreated seeds were seriously injured by the fungus. When applied to the seed ceresan also partially protected the sprouts from infection by *S. sclerotiorum*, and when both seeds and mummified peas were treated, very accurate germination readings were obtained, while cuprous oxide was noticeably less effective. Taken collectively, the results showed that the two fungi destroy many seeds and sprouts in germination tests of untreated seed and thus reduce the accuracy of the reading, and that treatment reduces infection and expedites the reading of the tests.

Ogilvie (L.), Croxall (H. E.), & Hickman (C. J.). **Cuprous oxide as a seed protectant for Peas.**—*Rep. agric. hort. Res. Sta. Bristol, 1939*, pp. 88–99, [1940].

Greenhouse and field trials are described of the effect of seed treatment with cuprous oxide on pre-emergence damping-off of peas (*Pythium* spp., including *P. ultimum*, *Fusarium*, and other genera) [*R.A.M.*, xix, p. 2].

In the first greenhouse test the percentages of emergence of seeds treated at the rate of 0·25 per cent. by weight in two samples of market-garden soils were 78 and 85 compared with 13 and 33 for untreated seed. In another test with eight varieties considerable increases in emergence were obtained, except when the untreated seed gave very high emergence, the averages of the percentages listed in the four sets of experiments being 84, 81, 82, and 83 for the treated seed and 67, 69, 39, and 48 for the untreated. Variation in the results is attributed to differences in the environmental conditions [ibid., x, p. 577], and experimentally it was confirmed that the shorter the interval between sowing and watering the greater was the loss due to pre-emergence damping off. In comparative tests with four proprietary organo-mercury seed dressings [unspecified] and cuprous oxide the latter compared favourably with the former.

In a field experiment, early sowings made on 25th February and 11th March, 1937, showed very marked pre-emergence damping-off, and treatment with cuprous oxide increased the percentage of seedlings emerging from 8 to 32 and from 26 to 65, respectively, in Surprise peas and from 23 to 61 and 31 to 67, respectively, in the Early Bird variety. In the later sowings under conditions favourable to germination the increase in stand from seed treatment was negligible. Other field trials confirmed these results. A comparative field trial of cuprous oxide with an organo-mercury product [unspecified] as a dressing showed the protection to be similar. Evidence is presented that cuprous oxide may retard the rate of seedling emergence and in dry soils may cause injury to certain varieties, e.g., Eclipse.